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Including articles on the Action Plan for Australia's imperilled plants, plant responses to fire and drought, Banksias and more!

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Front cover: Micro-grafting of *Banksia occidentalis* from Western Australia onto eastern Australian *Banksia integrifolia* rootstock better adapted to moisture and temperature levels occurring in the Australian National Botanic Gardens. Photo: Australian National Botanic Gardens

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Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research and diary dates are welcome. General articles on any plant conservation issue are most welcome.

The deadline for the spring 2021 issue is 1 August 2021. If you are intending to submit an article or wish to discuss possibilities, please email the editor, Heidi Zimmer: **editor@anpc.asn.au**.

Authors are encouraged to submit images with articles or information. Please submit images in electronic format, resolution needs to be at least 300 dpi, at least the size that they are to be published, in tif, jpg or gif format. Guidelines for authors and an article template are at: **http://www.anpc.asn.au/apc**.

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From the editor

HEIDI ZIMMER

Winter is here, and so too the winter edition of Australasian Plant Conservation. We begin with an introduction to the recently released Action Plan for Australia's Imperilled Plants by Jen Silcock and others. This important work highlights not only Australia's 50 most imperilled plants, but trends in threats and conservation actions needed, providing an incredibly useful resource for everyone working with Australia's native flora – and especially those of us working in conservation.

Next we dive into research on *Solanum sulphureum* (Manning Yellow Solanum). *Solanum sulphureum* was only described in 2009, is endemic to the Manning Valley in NSW, and is listed as Endangered in both NSW and at the federal level. Large parts of this species' distribution were burnt in the 2019-2020 bushfire season and, after significant rainfall, this has resulted in mass germination at the known sites. Further post-fire surveys also discovered *S. sulphureum* at several new sites. Our next article continues the focus on NSW threatened flora: Darren Shelly and co-authors describe evidence of post-drought recruitment events for the Endangered *Zieria obcordata* and Critically Endangered *Zieria odorifera* subsp. *copelandii.*

In a change of pace, Sabrina Sontaag takes us on a walk through the new Banksia garden at the Australian National Botanic Garden in Canberra. This garden is a remarkable place indeed, with more than 80 Banksia species, subspecies, cultivars and varieties which, when viewed side by side, bring home the morphological diversity – and synthesis of the group. A deeper appreciation for this display will be held by gardeners who may have tried (and failed?) to grow any of the more-challenging species at home.

News from the Australian Seed Bank Partnership covers the story of 250 *Glycine latrobeana* seeds. These special seeds were collected from Mount Bold Reservoir Water Reserve in South Australia in 2009, held in the Millennium Seed Bank (Kew), and then returned to the Adelaide Botanic Gardens for propagating and restoration efforts in the Mount Lofty Ranges (after fire impacts in 2019). We then hear from Samantha Craigie and Lucy Commander on the future of native seed management in Australia, and in particular the progress of Project Phoenix. The winter issue of APC is bought to a close with a profile of a new ANPC committee member, two book reviews, news, conferences and research round up.

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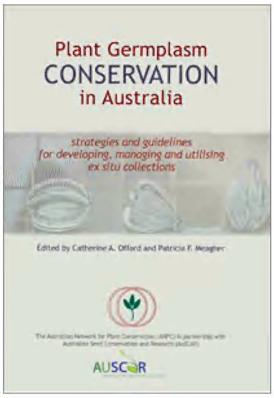

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AUSCOR

Introducing the Action Plan for Australia's Imperilled Plants 2021

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The Action Plan for Australia's Imperilled Plants 2021 was released in April 2021. Here we provide some background to the Plan, discuss its aims and how it can be used by decision makers, researchers and local communities to promote the survival of some of Australia's most threatened species.

Background to the Action Plan

The Australian flora: evolution, human interactions, threats and trends

The Australian flora is globally distinct, with more than 90% of its >22,500 native vascular plant species occurring nowhere else in the world (Chapman 2009). A small proportion of the flora are widely cultivated in gardens and parks, or are well-known as spectacular (spring wildflowers of south-western WA), iconic (desert Ghost Gums, giant boabs of the Kimberley), biogeographically intriguing (the Wollemi Pine and Central Australian Cabbage Palm), and increasingly, gourmet (saltbush, Mountain Pepper-berry, Quandong, Davidson Plum). However the vast majority of Australia's plants are cryptic, seldom-observed and poorly-known. The rate of 'discoveries', with an estimated 250 flowering plant taxa newly described each year in Australia (Chapman 2009), is testament to the relatively poorly-known nature of our flora from a scientific perspective. However, this is not the case in other knowledge systems.

Humans have observed, utilised, mythologised and altered the Australian flora since their arrival at least 65,000 years ago. Over 4,000 vascular flora species – nearly 20% of the scientifically-described flora – were, and some still are, used by Aboriginal people as food and medicine, and many more species were used as materials (Ens *et al.* 2017). Anthropogenic fire management, human niche construction, modification of trees and the intentional dispersal and nurture of important plants have collectively influenced the distribution and composition of vegetation communities and species across the continent.

Over the past 200+ years, European colonisation has greatly accelerated anthropogenic changes to Australia's vegetation, most drastically through extensive clearing for agriculture and urbanisation, particularly in coastal and sub-coastal areas in the east and south of the continent. Fragmented remnants in heavily cleared areas are now subject to ever-present threats including weed invasion, increased herbivore densities, lack of appropriate disturbance regimes, changed hydrology, infrastructure maintenance, and pollution and run-off from adjacent land-uses. Even seemingly intact vegetation can be negatively impacted by weeds, herbivores, altered fire and disturbance regimes, pathogens such as phytophthora and myrtle rust, and, increasingly, climate change.

Vascular plants underpin the structure and function of all terrestrial ecosystems and comprise over 70% of nationally threatened species in Australia. Australia's parlous record of species declines and extinctions since European colonisation is well-documented for mammals (Woinarski *et al.* 2015) and birds (Szabo *et al.* 2012). The most recent conservation assessment of Australia's threatened flora (Silcock and Fensham 2018) provided a timely update to the preceding assessment undertaken more than two decades ago (Briggs and Leigh 1996).

While a re-assessment of extinction likelihood shows that only 12 plant taxa have probably become extinct since European colonisation (Silcock *et al.* 2020), the first continental analysis of trends of Australian threatened plants, combining data from 112 species at 600 sites, reveals that threatened plant populations have declined by almost three-quarters on average in two decades – a much higher rate of decline than birds or mammals (Threatened Species Index 2020).

Aims of the Action Plan

This Action Plan aims to highlight the plight of Australia's most threatened plant species and outline research and management actions required to halt future extinctions. The Plan is modelled upon and designed to complement the recent Action Plans for Australia's Threatened Birds (Garnett *et al.* 2011 and in prep.), Mammals (Woinarski *et al.* 2014), and Lizards and Snakes (Chapple *et al.* 2019).

Similar to the other Action Plans, this Action Plan aims to:

- Identify the plant species most urgently requiring conservation management to reduce extinction risk.
- Provide a comprehensive and consistent review of the status of these species based on IUCN (International

Union for the Conservation of Nature) criteria, which can inform the ongoing CAM (Common Assessment Method) process.

- Identify management actions required to recover these species.
- Identify critical information gaps that compromise conservation status assessments and conservation management.
- Provide a baseline for charting changes in population parameters, trends and conservation status for our most imperilled flora.

Methods and overview

Identification of imperilled species for inclusion

Given the sheer number of rare and threatened plant species occurring in Australia (>1,300 are listed as threatened at a national level and at least ten times this number as rare or threatened in State and Territory jurisdictions), it was not feasible to provide comprehensive reviews of the current conservation status of all threatened plants (as in the aforementioned Action Plans). Instead, detailed profiles were compiled for the 50 Australian plant species identified as having the highest extinction risk– hereafter termed the 'imperilled' plants.

Data were compiled on all Australian plant taxa listed as Critically Endangered and Endangered under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and/or State or Territory legislation, through desktop review and >100 expert interviews (see Silcock and Fensham 2018 for details). This process focused on identifying species with continuing declines, which were then scored according to magnitude and certainty of decline, abundance of the taxon and extinction risk. Silcock and Fensham (2018) identified 418 taxa with documented, suspected or projected continuing declines. Of these, 55 had documented continuing declines across all subpopulations and were considered to be at very high risk of extinction within three generations or 100 years, whichever was longer (IUCN 2019). These species, along with a further eight that have subsequently been identified as imperilled, are the focus of the Action Plan. Seven species assessed as imperilled in 2018 have subsequently had doubts raised about their taxonomy, while three have increased in abundance due to management actions, and these are not included in the Plan.

Compiling Action Plan profiles

The majority of the Action Plan comprises standardised accounts of the conservation status of Australia's most imperilled plants. The profile templates were adapted and modified from the Bird and Mammal Action Plans, and focused on presenting key IUCN thresholds and recovery actions. Each profile was reviewed by relevant experts in 2020 to ensure the most current and accurate information was presented.

The profiles are split into the following sections:

- An overview, providing a summary of the key information about the taxon.
- Brief morphological description and reference to taxonomic authority.
- Distribution information including a map showing current and former natural and translocated occurrences of the species.
- Population estimates and trends, with timeseries data tabulated where available.
- Summary of key habitat and ecology information.
- IUCN Red List assessment data.
- Threats and threat impacts.
- Current management.
- Information and management actions required and their priorities.
- Experts consulted.

Structure of the Action Plan

Chapter 1 outlines the context and aims of the Action Plan. Chapter 2 details methods and definitions used in the Plan, including explanations of information provided in each species profile. Chapter 3 presents an overview of the 50 imperilled species, including regions and habitats where they are concentrated and the threats to their survival. Chapter 4 contains the 50 standardised species profiles (see above). Chapter 5 summarises recovery actions, research required and management priorities to prevent extinctions of Australia's imperilled species.

***Grevillea* sp. Gillingarra (R.J. Cranfield 4087) is known from a single population on a disturbed weedy rail reserve in south-western WA. Half of the small population was destroyed in 2011 due to railway maintenance and flooding, and declines are projected to continue. Life history research, habitat protection and restoration and translocation to secure tenure are required to ensure its survival. Photo: Andrew Crawford**

Imperilled species: overview, threats and conservation assessments

Distribution of imperilled species

Imperilled species are concentrated where centres of endemism correspond with highly modified agricultural and urban landscapes: the east, south-east and south-west of the continent (Figure 1). Imperilled species come from only 26 of Australia's 89 bioregions. Western Australia accounts for 15 species, all from the heavily-cleared and highly endemic Southwest Australian Floristic Region (Hopper and Gioia 2004), particularly the Avon Wheatbelt bioregion where seven imperilled species occur.

Eleven species are endemic to Victoria (including two that previously occurred in other States where they are now considered extinct). While six of these occur in heavily cleared bioregions such as the Southern Volcanic Plain, South East Coastal Plain and Riverina, the other five are narrow-range mountain endemics that face a variety of intensifying threats. Thirteen species occur in New South Wales and 11 in Queensland (including five found in both States). Eight of these occur in South Eastern Queensland, where historic and ongoing land clearing for agriculture and urbanisation has been exacerbated by the recent arrival of myrtle rust. Tasmania has three species, and South Australia two.

Australia's arid zone and northern savannahs are far less modified than more arable and populous regions, and while there are numerous dryland shrubs and trees with limited or no recruitment, and some restricted species are at long-term risk of extinction as older plants senesce, none were considered imperilled.

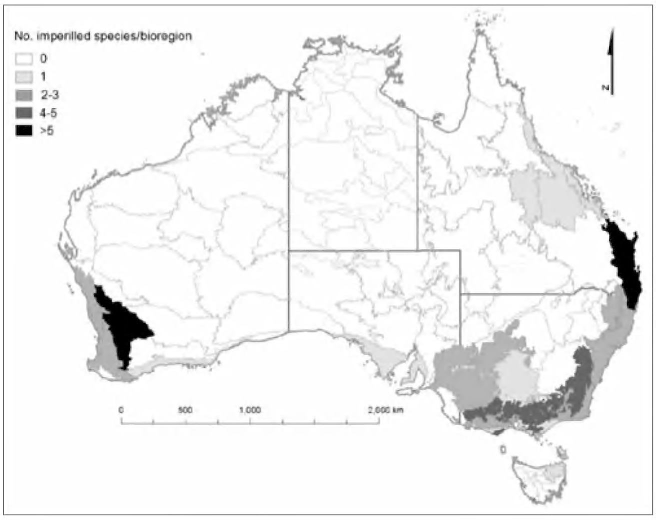

Figure 1. Number of imperilled species by biogeographic region (DAWE 2012), Australia.

Threats

Over 60% of Australia's imperilled plants have suffered historical declines due to habitat clearance and now survive as fragmented subpopulations in small patches of remnant vegetation. These remnants are typically not managed for conservation, often occur in road and/or rail corridors, and are inherently vulnerable to further loss and degradation from infrastructure maintenance, weed invasion, edge effects (*e.g.,* eutrophication, spray drift), high herbivore densities and human activities. In many cases ecological processes, particularly those driving recruitment (*e.g.,* fire, pollinator activity), have been disrupted.

Many remnant shrub subpopulations are comprised of mature individuals with limited recruitment due to lack of fire or other disturbance, often exacerbated by herbivory and/or competition from weeds and native vegetation. Limited recruitment is a high impact threat for 21 imperilled species. This represents an 'extinction debt' that will play out in the absence of active disturbance management as older plants senesce. Moreover, some species may have fallen below a minimum viable population size for long-term persistence.

The other 40% of imperilled species occur in less heavily modified habitats, mostly mountain ranges and upland rainforest. The threats to these species are species- and site-specific, and include infrastructure maintenance, native herbivores, insect borers, mites, and introduced pathogens. Most taxa are characterised by low recruitment and poor understanding of their seedbank ecology. The future impacts of climate change are also poorly understood, but for geographically restricted species are often predicted to be severe, particularly in concert with other threats.

Two plant diseases are at the forefront of conservation concerns in Australia, and are directly responsible for the imperilled status of 10 species. The threat from phytophthora (*Phytophthora cinnamomi)*, a soilborne water mould pathogen that destroys the roots of infected plants, is well documented (Cahill *et al.* 2008), particularly in the Eastern Stirling Range Montane Heath Community where numerous endemic taxa are threatened with extinction (Barrett and Yates 2015). Phytophthora has also been documented in forests of Victoria and New South Wales, and is responsible for continuing declines of five imperilled species, often in conjunction with other threats.

Myrtle rust, a plant disease caused by the introduced fungal pathogen *Austropuccinia psidii,* was first detected in New South Wales in 2010 and has now been observed on 382 (17%) of the 2,253 native Myrtaceous taxa (Makinson *et al.* 2020). The impacts of myrtle rust are most pronounced in Australia's east coast rainforest flora, and vary from restricted leaf lesions to impaired fecundity (infection of growing shoots, flowers, fruit and seeds) and plant death (Makinson *et al.* 2020). Some restricted and already threatened species are extremely susceptible to infection including *Gossia gonoclada* and the undescribed *Lenwebbia* sp. Main Range (P.R.Sharpe + 4877). Even more-widespread species such as *G. hillii, Rhodomyrtus psidioides* and *Rhodamnia maideniana* face sharp extinction trajectories due to severe impacts across their range (Fensham *et al.* 2020).

Climate change, specifically long-term drying trends, is ranked as a high impact threat to four imperilled species, and a potential future threat for many species mainly through decreasing winter rainfall trends in southern Australia, increased temperatures and drying in alpine areas.

Conservation assessments

All 50 species included in the Action Plan meet IUCN (2019) criteria for listing as Critically Endangered (CR). The majority are eligible for listing as CR under criterion B (45 species) and criterion C (41 species). Thirty species are eligible for listing as CR under criterion D, meaning that they are known from <50 mature individuals (seven of these are known from <10). Fourteen are eligible under criterion A, involving a quantified decline. Only one species, *Grevillea caleyi*, had extinction probability quantified; all others were assessed as Data Deficient under criterion E.

Ballantinia antipoda (Southern Shepherd's Purse) is a monotypic endemic historically known from numerous locations in Victoria and a single population in Tasmania; it is now restricted to Leanganook (Mt Alexader) in central Victoria. It undergoes extreme population fluctuations in response to seasonal conditions, but the number of subpopulations continues to decline and its range is contracting. Reasons for this decline are not well-understood, but its habitat is highly disturbed with a predicted drying trend under climate change. Photo: Paul Foreman

Borya mirabilis (Grampians Pincushion-Lily) is a 'resurrection plant' known from a single population comprising four colonies on a rock ledge in Gariwerd (Grampians National Park). Phytophthora has exacerbated existing declines due to drought, erosion, herbivore disturbance and post-fire competition with native species. A translocation attempt to a disease-free area was initially successful, but all plants had died by 2019 due to lack of site maintenance. Regular monitoring and management are required, as well as establishing an _ex situ_ insurance population. Photo: Neville Walsh, Royal Botanic Gardens Victoria

Only seven species had an Extent of Occurrence greater than 100 km^2, while 31 had an Area of Occupancy of <10 km^2. Thirty-two species are known from a single location, and all except five from <5 locations. All species had continuing declines observed, estimated, inferred and/or projected.

Recovery actions, research and management priorities

Imperilled species

Most of the 50 imperilled species have strong recovery prospects with intensive site-based management, often complemented by *ex situ* conservation and translocation efforts. For many species, this will involve a continuation and expansion of existing recovery efforts. Some species, however, have become restricted to a tiny number of plants at one or two degraded sites, and long-term recovery is wholly dependent on *ex situ* options.

Monitoring is a high priority for all imperilled species to inform population trends and response to threats and recovery actions. Given the restricted distribution and low population abundance of most imperilled species, monitoring will involve complete censuses conducted at regular intervals using repeatable monitoring techniques appropriate to each species. Most imperilled species would benefit from targeted research into their life history and ecology, particularly in terms of seed biology and germination requirements, appropriate disturbance/ fire regimes, and susceptibility and responses to disease.

Thirty-four species are restricted to small remnants (reserves, private land, or road and/or rail reserves) in highly modified habitats. Twenty of these occur predominantly on road and/or rail reserves, highlighting the need to enhance the protection of these linear remnants, and for their appropriate management. Twenty-nine species occur wholly or partly on private land, and halting further habitat loss through strengthening legislative protection and securing perpetual conservation agreements is a high priority.

The most common recovery actions required to abate population declines fall under the broad banner of habitat protection, management and restoration; encompassing protection from feral, native and/or domestic herbivores, invasive weed control, protection from infrastructure maintenance activities, and disease management. For species affected or potentially affected by phytophthora, this involves site hygiene measures (*e.g.,* reducing access, foot washing facilities), phosphite spraying and ongoing monitoring of impacts, including interactions with other threats such as fire and grazing. For the five species imperilled due to myrtle rust, recovery options are currently limited to ongoing monitoring, identification of less susceptible genotypes, collection of cuttings for *ex situ* propagation and potential future translocation, and research relating to the genomics of the myrtle rust pathogen.

Fire management is a high priority for 33 species, including 28 that require planned burns or other active disturbance to stimulate recruitment and/or reduce competition from surrounding vegetation. The 2019-2020 wildfires stimulated recruitment of four imperilled New South Wales species; despite this, all remain known from tiny populations and require ongoing post-fire monitoring and management. A lack of fire is a threat to more imperilled plants than is too frequent fire.

Ex situ collections (including seed banking, seed orchards and/or living collections in botanic gardens) for insurance and potential future translocation have been established for all except 10 imperilled species. Translocations have been attempted for 22 species, and are a high priority for a further 20. Some translocated plants of 16 species are surviving, although there has been no recruitment of 14 species. Long-term translocation success is far from assured, and translocations must be implemented in conjunction with *in situ* recovery of wild subpopulations and *ex situ* conservation (Monks *et al.* 2019; Silcock *et al.* 2019).

Conservation listings underpin funding priorities as well as providing a level of protection from land clearing and development activities. Correcting misalignments between jurisdictions and achieving comprehensive and up-to-date extinction risk assessments for Australia's vascular plants (Alfonzetti *et al.* 2020) are urgent priorities.

Poorly known species

Numerous potentially imperilled species were excluded from the Action Plan due to a lack of time-series monitoring data to document declines, or a lack of survey effort across the range of the species. The impacts of the 2019-2020 wildfires on threatened plants are still being documented and are likely to be variable depending on the disturbance ecology of the species. Some apparently rare flora are likely to germinate *en masse* following fire, which is an integral component of their life cycle. Other species that inhabit fire-refugia may have undergone significant declines due to unprecedented burn incursion.

Large numbers of highly-restricted ground orchid species are known from very small numbers of plants in one or two locations. However, members of these genera are cryptic and fluctuate seasonally in emergence and flowering, making trends difficult to detect without long-term data. Short-lived forbs can also be cryptic and experience extreme fluctuations in relation to seasonal conditions and disturbance, making inference of long-term trends difficult. There are numerous species

Daviesia cunderdin has only ever been known from a single population on a narrow road verge in a highly fragmented agricultural landscape, and only two individuals remain. High seed germinability and ongoing translocation provide promise of recovery, along with ongoing weed, pest and fire management. Photo: Natasha Moore

Gossia gonoclada (Angle-Stemmed Myrtle) occurs entirely within the urban footprint of Greater Brisbane, and was presumed extinct for over a century. It occurs in small, highly modified and weedy remnants, and only one subpopulation contains more than two naturally occurring plants. Population declines are ongoing due to a variety of threats, including high susceptibility to the introduced pathogen myrtle rust. Photo: Tamara Taylor

that occur in modified habitats that have not been seen in recent decades. Such species are of the highest priority for targeted surveys, research and monitoring.

Addressing taxonomic uncertainty

Some potentially imperilled species remain taxonomically uncertain, notably numerous ground orchids.
The taxonomic status of these taxa needs to be validated before any conservation actions can be determined. Emerging molecular systematics and taxonomic research shows that some orchid species included in the Action Plan are difficult to distinguish based on the genetic markers so far investigated (H. Zimmer pers. comm. 2020). In cases where a taxon is also difficult to distinguish morphologically, further work is required to clarify taxonomic status. Clear definition and treatment of such taxa will underpin future conservation planning.

Future directions

The Action Plan highlights five key areas that will underpin and advance conservation of the most imperilled elements of Australia's unique flora:

1. Continue and expand site-based conservation of all imperilled species. Numerous recent examples show that targeted and adequately funded recovery actions have mitigated population declines, and in some cases facilitated increases in population abundance for some highly threatened species.
2. Ensure that monitoring is consistent, repeatable and uses species-appropriate methods, to allow confident interpretation of population trends in response to threats and management actions.
3. Pursue targeted surveys and research on poorly known species where threats and/or declines are inferred or suspected.
4. Support taxonomic research to clarify the status of potentially imperilled species.
5. Review this Plan in 10 years to inform the trajectory of our most imperilled plant species, encompassing the plants included here and others that may subsequently be assessed as imperilled.

While the Plan can guide recovery actions by conservation practitioners and agencies, we also hope it will be adopted by local communities. Many of the imperilled species grow close to urban centres, and what they need most urgently is simple: people to know where they are, keep an eye on them, and advocate for them and their habitat.

Zieria exsul **(Banished Stinkbush) occurs on the Sunshine Coast in south-east Queensland, and its habitat has been extensively cleared for agriculture, housing and infrastructure. The four known subpopulations occur in small remnants that are subject to a variety of threats. A proposed transport corridor will destroy >95% of the total population. No reserves are actively managed for this species, whose life history and disturbance requirements are poorly understood. Photo: Glenn Leiper**

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Recent wildfires reveal large populations of the endangered Manning Yellow Solanum (*Solanum sulphureum*)

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Introduction

Solanum sulphureum (Manning Yellow Solanum) is a short-lived shrub endemic to the Manning Valley in NSW. Despite its large size (to 3 m tall), eye-catching flowers and distinct juvenile leaves (Figure 1), the species was only described in 2009.

The discovery was made by taxonomist Dr Tony Bean who, after examining an unidentified *Solanum* specimen collected from Killabakh Creek near Taree in 1983, concluded it was an undescribed native species (Bean 2009). Further exploration of herbarium archives by Tony uncovered a substantially older specimen of *S. sulphureum* from 1892. Fast forwarding to 2019, only six small disjunct populations in the Taree and Wingham localities were known (Cameron and Segal 2019). This highly restricted occurrence and presence of severe threats at known populations support the species' listing

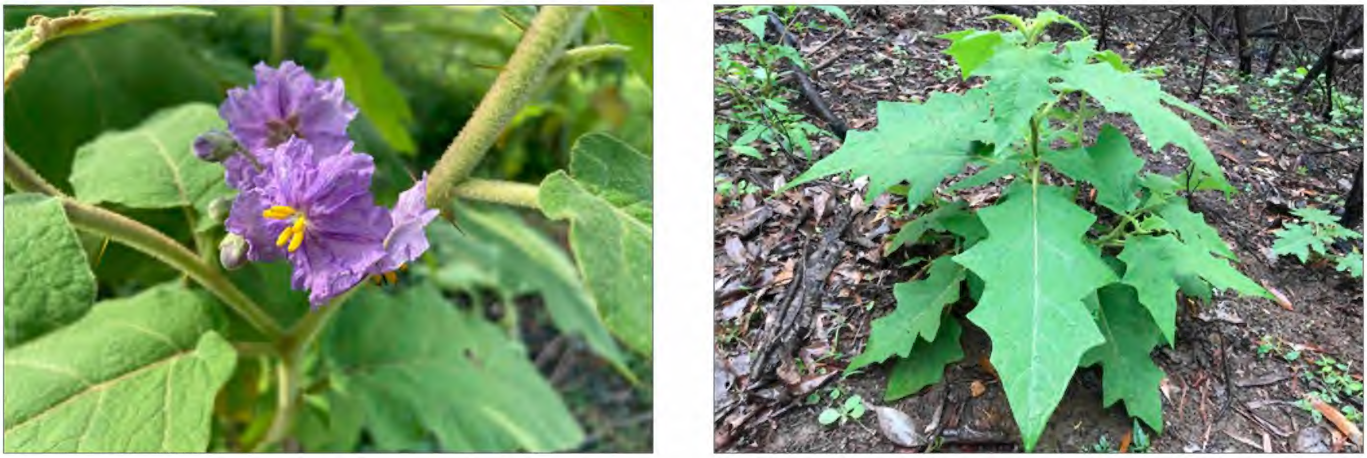


Figure 1. *Solanum sulphureum* with flowers (left) and young *S. sulphureum* with distinctive lobed juvenile leaves (right). Photos: Aaron Mulcahy

status as Endangered under NSW and Commonwealth biodiversity conservation legislation.

The rarity of *S. sulphureum* may be partly attributed to its 'weedy' appearance, as most known populations occur in disturbed areas with other exotic species such as Wild Tobacco Bush (*Solanum mauritianum*). Because much of the species' habitat occurs on private rural land it may be overlooked or actively destroyed as landholders may perceive spiny 'bush tomatoes' to be noxious weeds or poisonous to stock (Bean 2009). However, such encounters may be exceptions as the species is short-lived (< three years) and seemingly requires specific conditions to germinate.

Post-fire population explosion

In November 2019, wildfires burnt through large areas of the north and south-east parts of the Manning Valley that included three of the six known *S. sulphureum* locations (Kiwarrak, Mooral Creek and Killabakh; Figure 2). Prior to the fires, surveys found that *S. sulphureum* was either absent or present in very low abundance (<35 plants) at the three known locations that were burnt (Richards 2017, Mulcahy 2019).

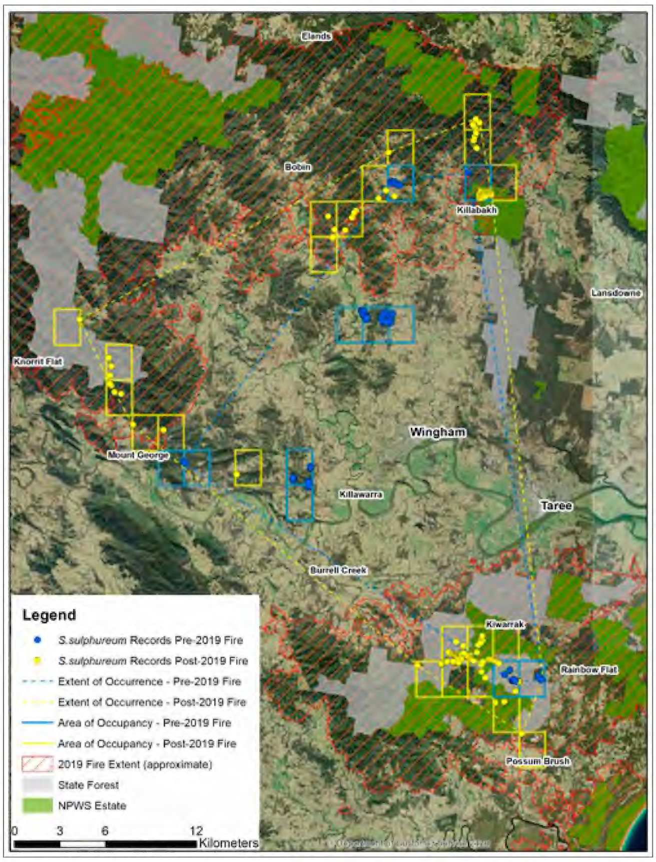

Elands
Bobin
Killabakh
Lansdowne
Knorrit Flat
Wingham
Mount George
Killawarra
Taree
Burrell Creek
Kiwarrak
Rainbow Flat
Possum Brush
Legend
● S.sulphureum Records Pre-2019 Fire
● S.sulphureum Records Post-2019 Fire
Extent of Occurrence - Pre-2019 Fire
Extent of Occurrence - Post-2019 Fire
Area of Occupancy - Pre-2019 Fire
Area of Occupancy - Post-2019 Fire
▨ 2019 Fire Extent (approximate)
State Forest
🟩 NPWS Estate
0 3 6 12
Kilometers

Figure 2. Map of *S. sulphureum* records pre and post bushfires in 2019. All pre-fire data are shown in blue and post-fire data in yellow. The Extent of Occurrence (EOO) and Area of Occupancy (AOO) are shown as dashed and full lines respectively. The extent of burnt areas from the bushfires are shown as hatched red.

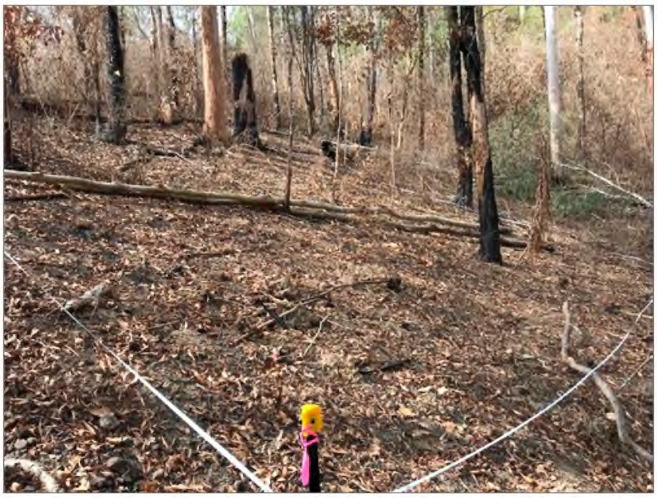
Post-fire monitoring was conducted under the NSW Government's *Saving Our Species* program (SoS) at two of the known *S. sulphureum* locations that were burnt (Mooral Creek and Kiwarrak State Forest). The fire intensity at both locations was high, with all vegetation strata (canopy, mid-storey and ground) completely burnt in most areas. Very little germination of *S. sulphureum* occurred at these sites during the dry conditions that persisted for several months after the fire until substantial rainfall in early February 2020. For example, a total of 554 mm of rain was recorded during February 2020 at Mooral Creek. By mid-March 2020, the *S. sulphureum* populations at both sites had increased exponentially, with large numbers of new seedlings recorded (Figure 3).

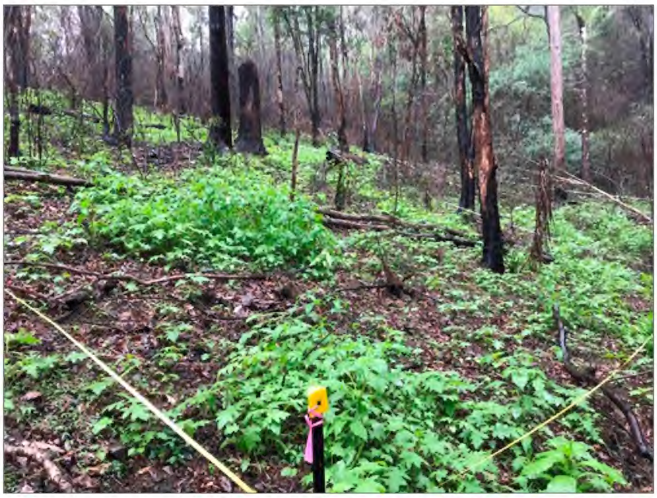
Previous observations of *S. sulphureum* seedling recruitment have all coincided with periods of extended rainfall, which suggest prolonged soil moisture is important for seed germination (Cameron and Segal 2019; Mark Drury *pers. comm.*). Past rain-induced recruitment events have been uncommon and sporadic, with seed germination most often occurring in areas of soil disturbance. For example, the population at Kiwarrak State Forest was discovered in 2013 in a recently harvested area, with the mechanical disturbance of the soil providing the stimulus for germination (Mark Drury *pers. comm.*). While soil disturbance can promote recruitment at small scales, the dramatic response of *S. sulphureum* at the burnt monitoring sites after significant rain indicates that fire is an extremely effective catalyst for stimulating mass germination of the species.

Population monitoring

Post-fire monitoring has been undertaken at the two burnt *S. sulphureum* SoS sites during 2020 and early 2021. Data on the species' abundance, growth stage and condition were collected across a series of 20 m x 20 m monitoring plots. To date, the monitoring has revealed the following key insights:

- Abundance of *S. sulphureum* was highest within the first six months after the primary recruitment event in February/March 2020.
- Abundance decreased at most of the monitoring sites within 6-12 months after recruitment (mean 33% decline from Sept 2020 to April 2021).
- Rapid growth of new seedlings occurred within the first six months with most plants attaining a height of 1-2 m (Figure 3).
- Flowering was observed six months after germination. The estimated proportion of plants in flower at September 2020 was 38% at Kiwarrak State Forest and <5% at Mooral Creek.
- Burnt adult plants have the capacity to resprout after fire, with new leaves emerging from the stems of several plants that were present before the fires (Figure 4).





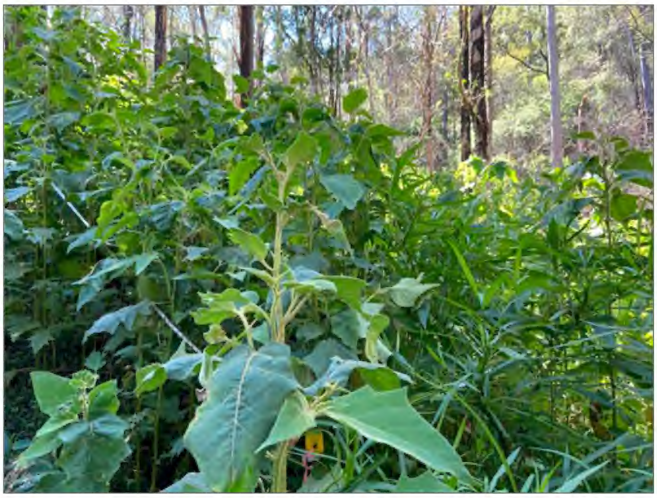


Figure 3. Photo points from Mooral Creek monitoring plot 2 in January 2020 after fire and before rain (top), March 2020 after substantial rain with *S. sulphureum* as the dominant groundcover (middle) and September 2020 with *S. sulphureum* forming a dense shrub layer after rapid post-fire growth (bottom). Photos: Aaron Mulcahy

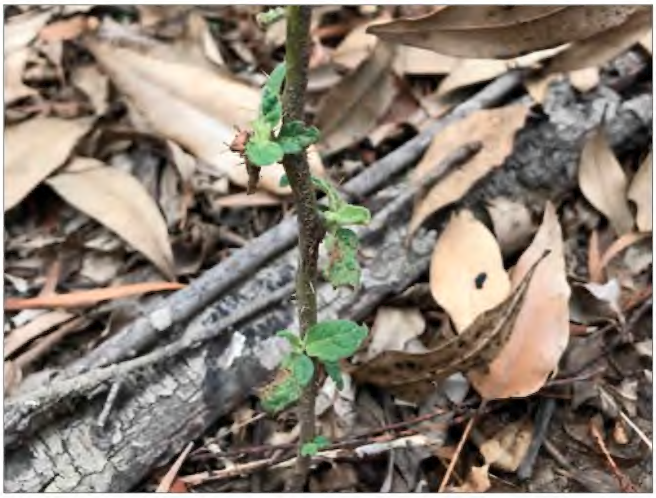


Figure 4. Post-fire resprouting of *Solanum sulphureum*, January 2020. Photo: Aaron Mulcahy

Expansion of known range

After observing the proliferation of *S. sulphureum* populations at known locations, further searches were undertaken during 2020 in other recently burnt areas of the Manning Valley to identify new populations. Searches were conducted across existing SoS management sites on private land, several NSW National Parks and State Forests, and public road reserves.

Numerous new *S. sulphureum* populations were discovered during the searches, extending its known distribution to the north, south and west. These findings include the first records of *S. sulphureum* on NSW National Park estate, with populations found in Goonook, Talawahl, and Killabakh Nature Reserves. New populations were also found at elevations up to 500 m above sea level (ASL), much higher than previous records which have been below 200 m ASL.

Collation of all population counts and estimates from the post-fire surveys and monitoring resulted in a substantial increase in the total estimated population size of the species': from ~600 plants pre-fire in 2019, to at least 20,000 plants post-fire in mid-2020. Given the relatively small area of burnt habitat that was covered during the searches, it is likely that the total population size is much larger than this.

A revised assessment of the species' extent of occurrence (EOO) and area of occupancy (AOO) was undertaken in accordance with the IUCN guidelines (IUCN 2019) incorporating all new post-fire records. The revised EOO of *S. sulphureum* is now 673 km^2 compared to an EOO of 424 km^2 in 2019 pre-fire, while the revised AOO is now 132 km^2 from an AOO of 44 km^2 in 2019 pre-fire (Figure 2). While this is a large increase in both EOO and AOO, the species' is still highly restricted in its occurrence and its classification as Endangered under the IUCN criteria remains appropriate.

Seed longevity

Nearly all new *S. sulphureum* locations identified during the post-fire surveys are in areas that have not been burnt in more than 50 years (based on available fire history records). It is likely that the species has been intermittently present in low abundance at these locations and been contributing seed to the soil since the last fire event. However, the scale and density of *S. sulphureum* recruitment observed in 2020 suggests many plants have germinated from seed that was produced when the species was last in high abundance (*i.e.,* most likely after the last major fire). These observations support previous suggestions that *S. sulphureum* seed is likely to remain viable in the soil for decades (*i.e.,* Tony Bean's previous estimate of seed longevity up to 40 years; Cameron and Segal 2019).

Future directions

The recent wildfires have presented a narrow window of opportunity to learn more about the distribution and ecology of this rarely seen fire ephemeral species. Future work that is planned to assist the long-term conservation of *S. sulphureum* include:

- Continuation of post-fire monitoring to document the species' life cycle and population dynamics.
- Further targeted survey with the help of community engagement and citizen science.
- Weed control for maintaining habitat quality and promoting the species' persistence.
- Identification of seed dispersal agents, *i.e.* monitoring of fruiting plants *in situ* with remote cameras to ascertain if fauna species are dispersing seed.
- Collection of seed from newly identified populations for *ex-situ* storage at the Australian PlantBank.

Acknowledgements

We would like to thank all our *Solanum sulphureum* SoS project partners for their support and contributions to this work: Paul Segal (Sassafras), Robert Dibben (Mooral Creek) and Mark Drury (Forestry Corporation of NSW). We would also like to thank the Hunter-Central Coast Saving Our Species team (Andrew Steed, Christophe Tourenq, Liz Crane and Paul Hillier) and NSW National Parks and Wildlife Service (Robert Brothers and Deanne Phillips) for assisting with the post-fire surveys, and Christopher Scott (Sustainable Natural Resources Group) for providing new locations of the species.

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In the Nick of Time – Post-drought recovery of two threatened Zieria species in central-western New South Wales

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Introduction

Granite Zieria (*Zieria obcordata*) is Endangered under the *NSW Biodiversity Conservation Act 2016* (NSW BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The perennial shrub grows to 100 cm and only occurs on granite outcrops in the Wellington and Bathurst districts in NSW. Monitoring has occurred since 2008, however most conservation management has happened since the start of the NSW Government's Saving Our Species (SOS) program in 2016. The greatest threat to the species is continuous grazing. In native forest, wallabies target plants at certain times, removing branches and reducing reproductive potential.

The Mount Kaputar Scented Zieria (*Zieria odorifera* subsp. *copelandii)* is Critically Endangered under the NSW BC Act but is not listed under the EPBC Act. This erect perennial shrub grows to 60 cm amongst boulders and rock crevices in shallow soils. All plants found to date form a single population within Mount Kaputar National Park. The subspecies was formally described in 2002 when *Z. odorifera* was split into four subspecies. Threats to the survival of the species are browsing by feral goats, death during drought conditions and wildfire. The recent drought and bushfires prioritised establishment of a SOS project in 2019-2020.

Population monitoring

Zieria obcordata Population censuses were scheduled for every five years, unless major changes in annual sub-population counts warranted further investigation. The first census was done in 2011 and this was followed by census in 2016. Census were conducted in 2019 and 2020 to get an accurate reflection on drought losses and will continue to ascertain the success rate of any post-drought regeneration through to maturity.

Previous monitoring has shown a more reliable indicator of plant population persistence is via adult plant counts rather than the total number of plants. Regeneration typically occurs after large rainfall events, however, all young plants are generally not sustained until they reach maturity (*i.e.,* capable of reproduction).

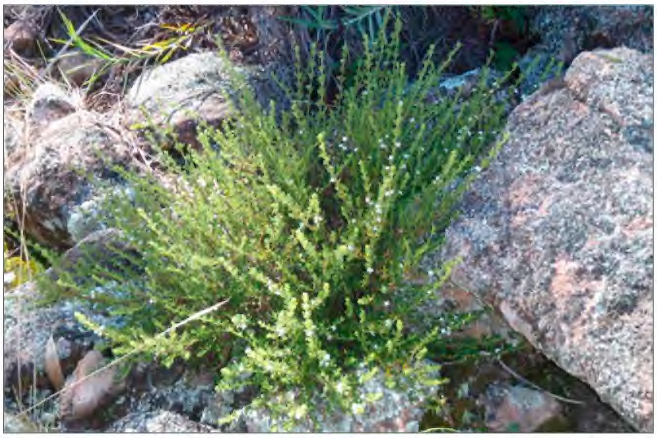

Figure 1. Mature *Z. obcordata* in granite rock habitat. Photo: Garry Germon

Zieria odorifera* subsp. *copelandii Due to the number of plants being very low (<15), a census of the known population was undertaken including a survey for new individuals. Surveys recorded mature plants or seedlings (a term which covers all young plants).

Population counts have varied from 10 adults in 2002, seven adults in 2012, up to 15 adults in 2015 and 12 in 2019. No recruitment of new plants was recorded was recorded.

The SOS project is to monitor the population in drought recovery at six-monthly intervals.

Drought impacts

Zieria obcordata Average annual rainfall data indicate the drought lasted through 2017, 2018 and 2019, as all three years experienced significant rainfall deficits at both Wellington and Bathurst zieria locations.

Plant abundance only decreased slightly over the three years of drought, with only one location at Wellington showing a large decline. This showed there was some resilience in mature plants to prolonged dry conditions. The turning point was actually a ten-day period from Christmas 2019 when a severe heatwave led to several consecutive days of 40-45°C temperatures. This proved too much for the already stressed plants and mass plant deaths had occurred by mid-January 2020.

Comparing the numbers of adult plants remaining in 2020 to the highest plant abundances recorded in 2016 (before the drought) gave an average loss of 82% across selected Bathurst locations with a range of loss from 70-91%. The Wellington sub-populations showed similar heavy losses with an average adult plant decline of 84% from 2016 levels and the range of loss being 56-100%.

Zieria odorifera* subsp. *copelandii Average annual rainfall data indicates the drought did not begin in the Narrabri region until 2018 which is a full year less than what was experienced at the *Z. obcordata* locations.

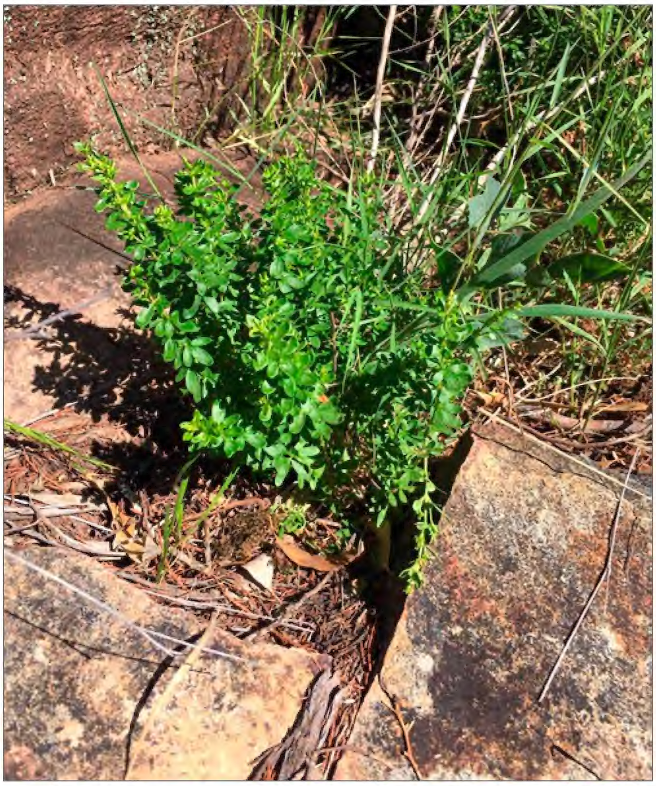

Figure 2. Mature *Z. o. copelandii* growing in rocks. Photo: James Faris

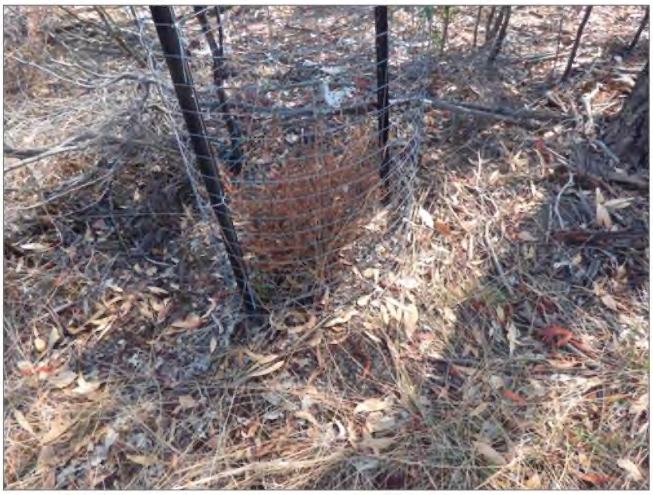

Figure 3. Drought death of protected *Z. obcordata* at Bathurst. Photo: Chris Dawe

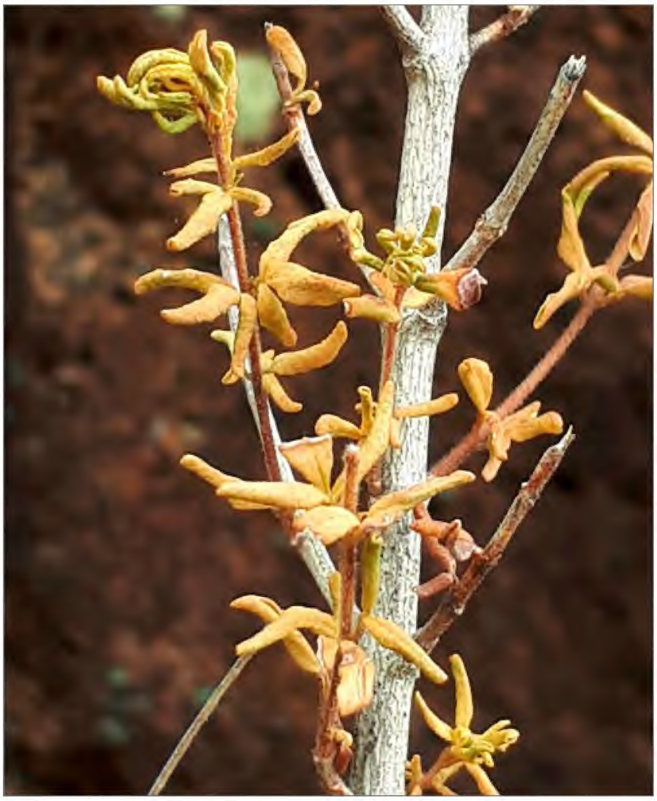

Figure 4. Drought affected *Z. o. copelandii*. Photo: Marc Irvin

The number of mature plants in this population reduced only slightly from 15 plants in 2015 to 12 in September 2019 (which was most of the way through the drought period). Deaths of several plants were noted during the extreme and prolonged heatwave over Christmas 2019-20 and emergency watering of the two remaining plants took place.

The population reduced to only two mature plants by 11th April 2020, a drop of 84%. This decline of plants between 2015-2020 was likely due to a combination of severe drought conditions over several years and excessive browsing by feral goats.

Post-drought recovery

Zieria obcordata The October 2020 census revealed large-scale regeneration had occurred with nearly 12,000 young plants counted across all sub-population locations. The scale of regeneration suggests three or four separate phases since March 2020, when the first rainfall event occurred, as no recruitment was observed before that time. The smallest regeneration cohort observed was seedlings less than 1 cm high, a second cohort seemed to be 3-6 cm high and another from 8-10 cm high with the tallest cohort 10-15 cm.

Almost all of the mature plants that survived the drought showed significant foliage growth and were flowering along with having numerous seed pods.

Zieria odorifera subsp. copelandii Surveys within the month of April 2020 show a large germination event occurred between the 11th and 23rd April as no seedlings were recorded on the 11th but by the 23rd, 477 seedlings were recorded. Bureau of Meteorology rainfall records for Narrabri Airport (site 504038) show 19.2 mm of rain fell on 3rd and 4th April 2020, which may have wet the soil. An additional 32.8 mm rain occurred on the 10th and 11th April which may have been the trigger for germination subsequently observed on the 23rd.

The next survey in September 2020 found 59% of the seedlings had died since April. However, 14 new seedlings were found nearby that appeared to have germinated between the April and September 2020 surveys. In January 2021, searches for new plants re-examined the new seedling locations with 230 seedlings recorded. Many of the plants were 15-20 cm high and multi-branched with stems starting to harden and become woody.

Conclusions

Zieria obcordata The recruitment event in 2020 is by far the largest recorded for this species. This event was the only one where preceding drought had near-denuded groundcover beforehand, as well as causing significant *Zieria* plant loss. One possible explanation for the massive germination could be that the rainfall events throughout 2020 (after March) were significant rainfall events spaced throughout the year, thus providing continual top-ups of soil moisture, before it could dry out to the point of impeding seedling growth.

Another potential explanation for the scale of this recruitment event is fire. Although the sites were not burnt in the 2019-2020 bushfires, smoke (and other remnants of the fire) were washed out onto the near-bare ground when the drought broke in March. This may have had the impact of applying smoke water across the region, increasing subsequent regeneration from the soil seed bank. ("Editor's note: Smoke water is water containing some of the chemicals which are found in smoke. It is used to stimulate seed germination in some species.") Heat and/or smoke water are well known treatments for seed germination in a number of plant species. While there were no *Zieria* sub-populations burned over that summer, both Bathurst and Wellington had a number of days reported as being blanketed by smoke haze.

The vast majority of recruitment first noted in March 2020 was still alive in October 2020 and remained alive in March 2021. If survival continues until the next census in October 2021, then the drought-breaking recruitment will more than make up for all the drought losses across all the sub-population locations and will lead to the highest known total population size for this species.

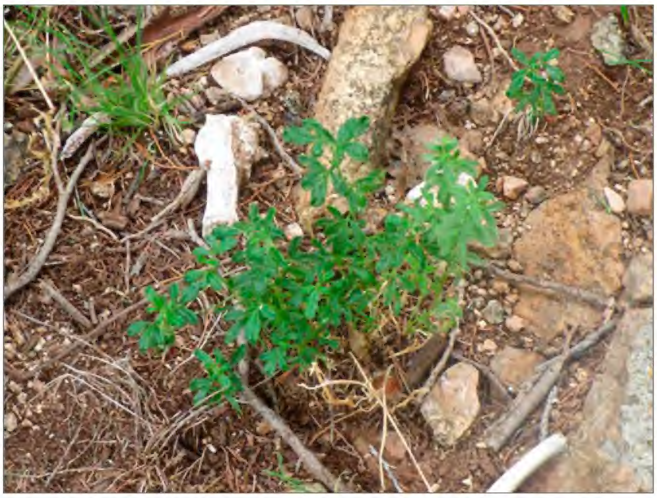

Figure 5. Typical cluster regeneration of *Z. obcordata*. Photo: Darren Shelly

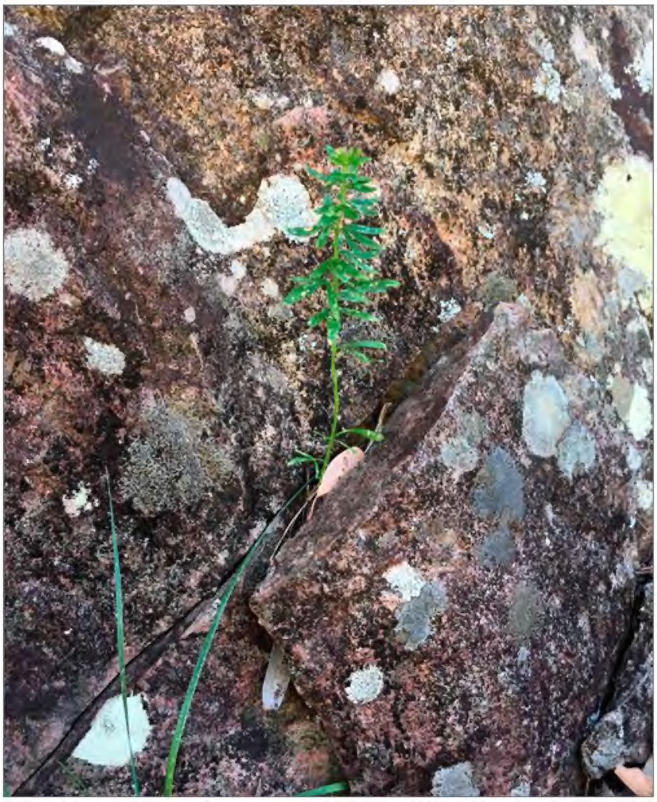

Figure 6. Juvenile *Z. o. copelandii* growing in rock crack. Photo: James Faris

Zieria odorifera* subsp. *copelandii Surveys and observation also show recruitment occurred in several phases throughout 2020. With such a small base of adult plants it is most unlikely they could produce enough seed in one season to produce so many seedlings. Given the drought lasted at least two full years in the region with no seed set, it is assumed that the soil seed bank had been established over a number of prior years and that such seeds have remained dormant but viable in the soil for long periods of time.

The reduction in seedling numbers from around 477 to 279 between April and September 2020 is consistent with what one would expect with a natural mortality rate of seedlings. Seedlings were often found in small clusters and in such cases, logic would argue that as they grew competition for resources would increase to the point where they would self-thin. It is also possible that seedlings have been eaten by feral goats in the time between surveys.

It would seem that for these two threatened *Zieria* species, if enough mature plants can be protected from continual browsing so that they can set seed in good times, then the species can withstand prolonged drought.

Acknowledgements

These projects are funded by the NSW Government through the Saving Our Species program. Census and surveys were conducted by the authors with in-kind support of staff from National Parks and Wildlife Service and the Biodiversity, Conservation and Science Division of Department of Planning, Industry and Environment. Additional survey support came from botanist volunteers (Paul Carmen and Cathy Hook) for *Z. obcordata* and ecologist contractors (Lachlan Copeland of Ecological Australia) for *Z. o. copelandii*.

Welcome to the Banksia Garden

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In October 2020, the Australian National Botanic Gardens opened a new garden dedicated to the genus *Banksia* in celebration of its 50th birthday. The garden has been carefully designed to showcase a diverse range of banksias, one of Australia's most fascinating plant groups.

The Banksia Garden features over 80 kinds of *Banksias* including subspecies, cultivars and varieties from across Australia and tells stories of their place in the Australian landscape. The primary focus is on members of the genus prior to the addition of *Dryandra* species.

Interpretive themes underpin the layout and include how Gardens' horticulturalists have cultivated some of the difficult-to-grow *Banksias*, life cycles of *Banksias*, pollination, and *Banksias* and fire. A burnt *Banksia* installation featuring twisted banksia trunk skeletons burned by fires in Booderee National Park on the New South Wales south coast creates effect and a link to the burnt wood used to construct the nearby Paperbark Treehouse.

A circular artwork positioned in the gardens' main courtyard highlights the variation in leaf shapes within and between species in the genus. Imprints of nearly five hundred leaves from thirteen *Banksia* species are arranged in a radiating pattern, reflecting the structure of a *Banksia* inflorescence.

Quotes in language from Indigenous Australians on the importance of *Banksia* to their culture together with English translations are embedded into the paths of the garden. These reflect the intimate link and rich plant knowledge that has been critical to the survival of Indigenous Australians and the fabric of the Australian landscape.

An entire section of the Banksia Garden is dedicated to Western Australian *Banksia* species including *B. baxteri*, *B. coccinea*, *B. prionotes, B. media, B. occidentalis*, *B. grandis*, *B. menziesii* and more. Another area of interest is a sand dune section showcasing *B. integrifolia*. A meandering creek along the eastern boundary of the garden links the *B. integrifolia* dune with drifts of *B. robur* in both the purple foliage form, "Purple Paramour" soon to be commercially released by the Gardens, as well as the green form. The creek provides the perfect environment for *B. robur* to thrive, as well as being a backdrop for the *B. integrifolia* dune. Another section is dedicated to showcasing the subtle differences within the *B. spinulosa* complex.

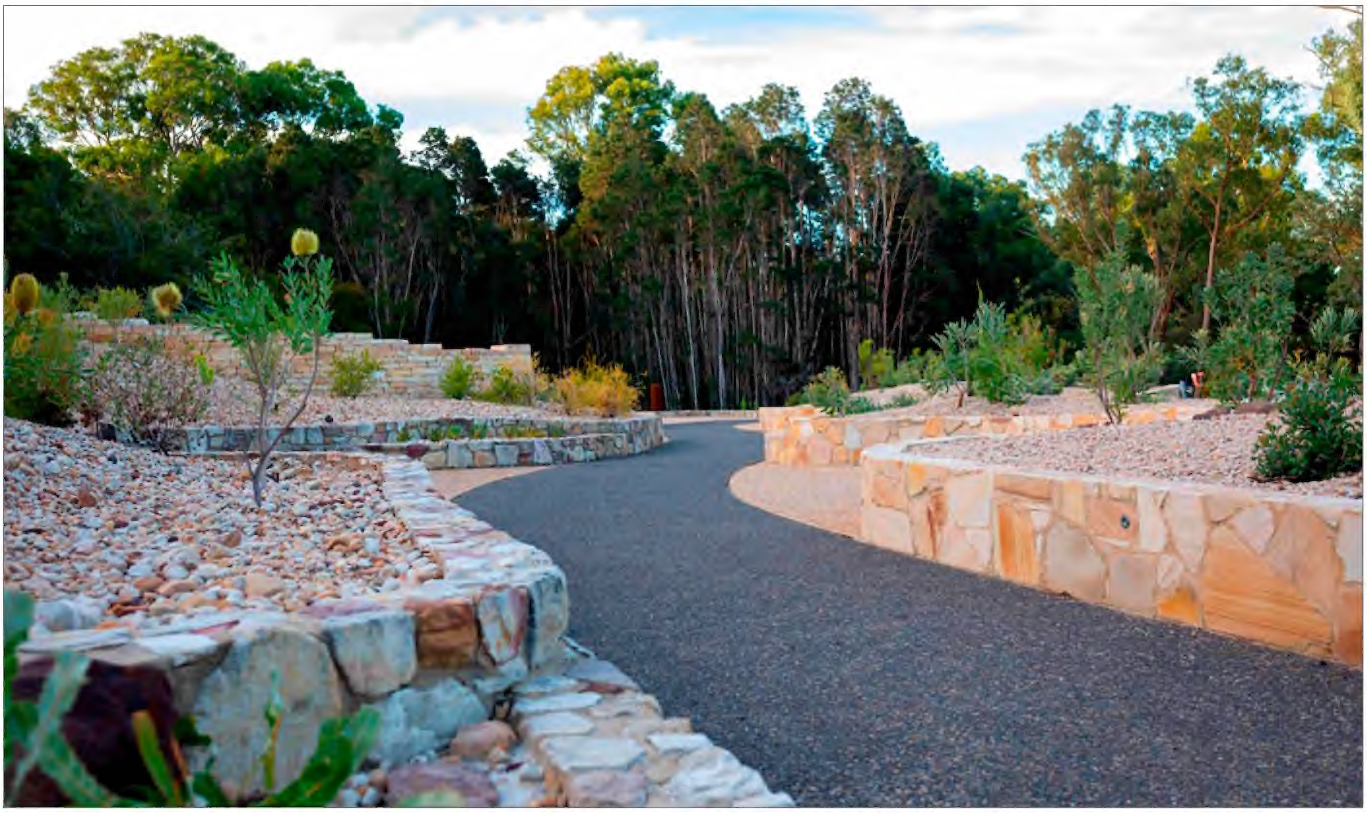


Figure 1. Stone walls contain mounds of specialised well-draining sandstone media to minimise water accumulation in the root zone. Photo: Australian National Botanic Gardens

The garden reflects the importance of banksias as part of the Australian flora from east to west. The highest diversity of species grows in southwestern Australia. Although lower in species diversity, eastern Australian banksias are some of the most well-known and widely distributed, such as *B. serrata* and *B. spinulosa*.

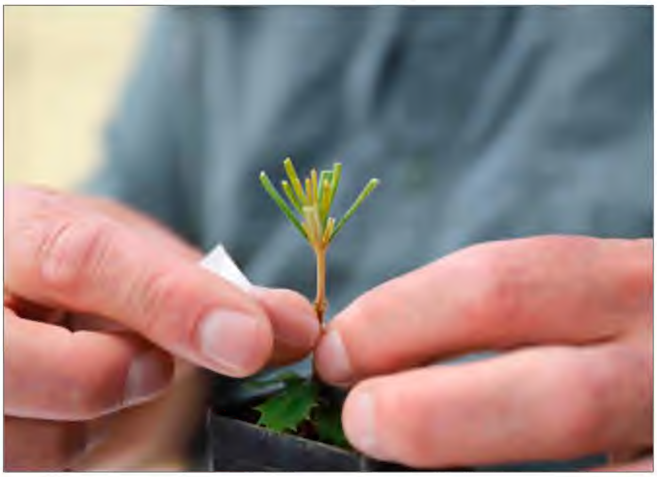


Figure 2. Micro-grafting of *Banksia occidentalis* from Western Australia onto eastern Australian *Banksia integrifolia* rootstock better adapted to moisture and temperature levels occurring in the Australian National Botanic Gardens. Photo: Australian National Botanic Gardens

While most banksias from eastern Australia are readily cultivated and can be seen growing in a range of locations and conditions, Western Australian *Banksias* are notoriously difficult to grow outside of their natural habitat. These banksias have evolved to grow in the ancient, nutrient-deficient sands, soils and gravels of Western Australia where summers are dry and hot. Under cultivation they are known for their intolerance to moisture in their root zone for extended periods. Many species are susceptible to the introduced root-rotting fungus *Phytophthora cinnamomi* which is widespread in Australia.

Attempting to grow a nationally representative collection of *Banksias* in the extremes of the Canberra climate where the Gardens is located presents unique challenges. The Gardens living collections team, working in partnership with banksia specialists from across the country, have developed and implemented a range of innovative and experimental techniques and approaches.

From the outset, the site was carefully chosen and remodelled to provide special growing conditions. For western species this centred on several key elements:

- Providing maximum drainage – this was achieved by replacing extensive areas of heavy soils, installing a robust drainage system in the sub soil and creating a series of tall mounds up to four metres deep using well-draining sandstone media.

- Testing growing success beforehand – a test area using the specially designed soil profile planted with Western Australian species was created prior to the garden build to confirm the suitability of the mix and assess the plant responses.
- Maximising sunlight and warmth – the area was cleared to give plants optimum sunlight and to maximise available sunlight hours. A north-facing thermal dry-stone wall has been built into the garden. The wall will absorb and radiate heat from the low angle of Canberra's winter sun to soften the bite of Canberra's winter temperatures for frost-sensitive species.

Select species are planted in large moveable pots filled with pasteurised potting mix. Pasteurising kills harmful pathogens within the soil that might damage or kill sensitive plants. Mobile pots mean that cold-sensitive species can be placed under shelter to protect against frost.

Behind the scenes, the Gardens nursery team had the challenge of propagating and growing on more than eighty varieties of *Banksias*, some to advanced sizes over 1.5 metres in height. This includes many unusual and rarely cultivated species, specially selected forms within species, and threatened, rare and uncommon species.

Innovative work grafting Western Australian *Banksias* onto eastern Australian rootstocks was achieved in partnership with *Banksia* specialists. The Gardens has focused on micro-grafting techniques and adapting cutting grafting methods. Grafted western *Banksias* are more adaptable and durable in a wide range of soils when growing on hardier eastern *Banksia* rootstocks. Through trial and error more than 25 *Banksia* species have been successfully grafted.

The Banksia Garden provides new opportunities, not only to inspire and connect visitors with an understanding of the wide diversity within the *Banksia* genus, but also to expand horticultural knowledge and to preserve threatened and endangered *Banksia* species.

The formation of the Banksia Garden has been a collaborative effort with experts from across Australia, including Alex George, Kevin Theile and Kevin Handreck. A generous donation from the Friends of the Gardens made the project possible. Expertise and material for propagation of plants has come from the Gardens' collections, specialist native plant growers such as Kevin and Kath Collins from the Western Australia Banksia Farm, Phil Trickett and Catriona Bate on the south coast of New South Wales, and specialist native seed suppliers, the Seed Shed in WA and the Australian Seed Company in NSW.

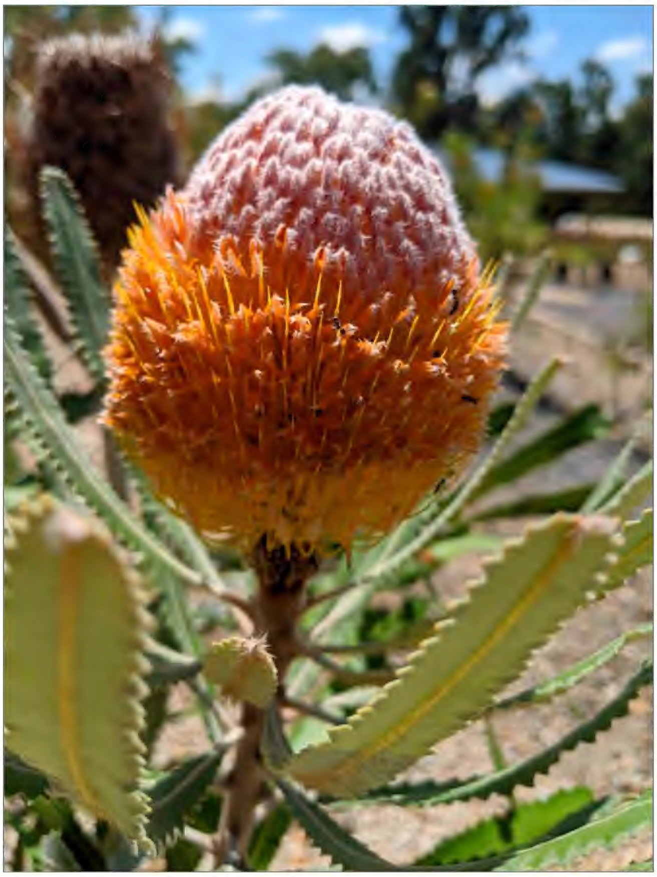


Figure 3. ***Banksia burdettii*** **is one of the many Western Australian banksia species growing in the Banksia Garden at the Australian National Botanic Gardens**

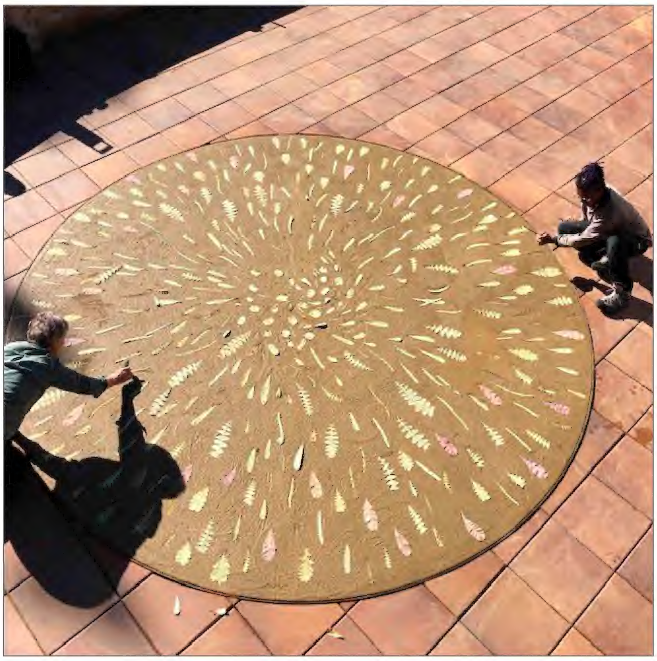


Figure 4. Australian National Botanic Gardens staff position banksia leaves that form a circular artwork positioned in the central courtyard of the Banksia Garden. Photo: Australian National Botanic Gardens

News from the Australian Seed Bank Partnership

Out of the Freezer, into the Fire: repatriation of a rare pea from the UK Seed Bank for bushfire recovery

DAN DUVAL* AND JENNY GUERIN

South Australian Seed Conservation Centre, Botanic Gardens and State Herbarium
*Corresponding author: Daniel.Duval@sa.gov.au

Note from ASBP: This article describes the repatriation of seeds from the Millennium Seed Bank to the South Australian Seed Conservation Centre following the Cudlee Creek bushfire in the Adelaide Hills. The story highlights the value of seed banking for restoration.

The need for seeds has arisen in a variety of projects over recent years from seed banks across Australia. However, when seeds are collected from threatened plants for long-term storage, the circumstances of their utilisation is not always predetermined. Seeds from the nationally vulnerable Clover Glycine (*Glycine latrobeana*) were collected from the Mount Lofty Ranges in 2009 by staff at the South Australian Seed Conservation Centre (SASCC) for safekeeping as part of the South Australian seed-banking program. A decade later an uncontrolled bushfire in the Mount Lofty Ranges burnt through 25,000 hectares in the Cudlee Creek region. Within this region there were small fragments of remnant vegetation that contained *G. latrobeana* as well as other significant threatened plant species.

These summer fires of 2019-2020 have led to native vegetation post-bushfire recovery projects, including a regional project to restore the Clover Glycine. Although the SASCC had a small collection of *G. latrobeana* seed recently collected from a private bushland reserve within the fire scar, the quantities stored were insufficient for recovery work. Fortunately a larger collection of 1,200 seeds from the Mount Bold Reservoir Water Reserve had been sent for storage in 2009 with our international partner, the Millennium Seed Bank at the Royal Botanic Gardens, Kew. In April 2020 we requested the extraction of 250 of the 1,200 seeds held in long-term storage for use to grow plants to support post-bushfire recovery.

These collections are stored on our behalf, for conservation purposes, by the Millennium Seed Bank (MSB) under an international partnership agreement between the Botanic Gardens and State Herbarium of South Australia and the MSB. Typically we aim to duplicate a number of conservation collections with MSB as a safeguard against loss of any collections held by one institution. We have utilised collections in long-term storage for several recovery projects in recent years. The partial repatriation of collections from long-term storage at MSB in the UK was a precedent for the Australian Seed Bank partners.

Seed repatriation involving the return of living material to Australia was also a precedent for Australian Biosecurity. The importation of seeds for a threatened plant species of wild origin in Australia is a rare occurrence and generated logistical questions for their (re-)importation. Many thanks to Matthew Green at Plant Import Operations (Dept. Agriculture, Water and the Environment) for providing assistance with the shipment.

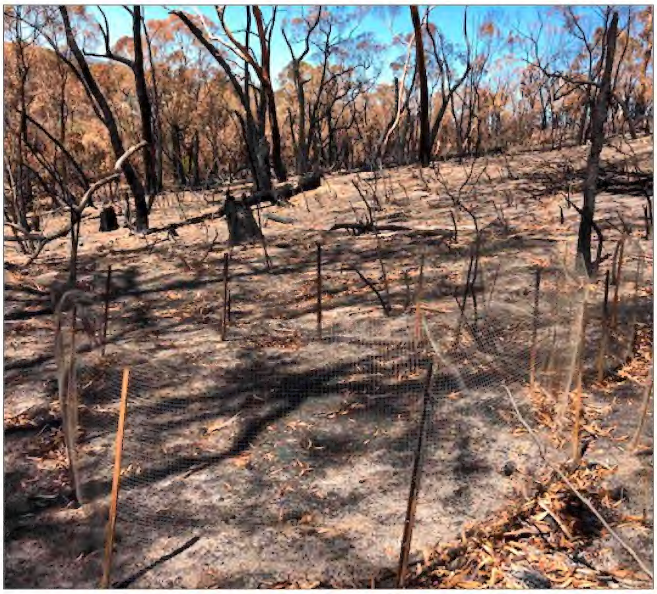
The seeds arrived in August 2020 and 230 plants were propagated for planting back into the fire scar in 2021 and for establishment in the seed production area at the Adelaide Botanic Gardens. By February 2021 nearly 800 seeds were harvested from the propagated plants to be used for ongoing recovery work. The propagation of plants for reintroduction in this project was initially considered as an opportunity to augment sites and populations in the post-fire environment. It was a supporting contingency as the expectation was that most populations of this rare pea that occur within the fire scar would respond favourably to the bushfire. However during monitoring of known population sites in the spring and summer of 2020, all sites had markedly reduced plant numbers or no plants present at all (*pers. comm.* Kieran Brewer, SA Indigenous Flora, 27 April 2021). In one private bushland reserved no plants could be detected at any of the three recorded population sites.

It is hoped that better plant numbers will be observed in spring 2021 and populations will gradually recover. Similar observations have been recorded for other threatened species within these bushfire affected reserves. A small disjunct population of the nationally vulnerable Leafy Greenhood (*Pterostylis cucullata* ssp. *sylvicola*) occurs in the Lobethal Bushland Park council reserve and monitoring in late spring 2019, a few weeks prior to the bushfire, recorded 144 plants. In spring 2020 no plants could be detected during multiple site visits. The fire intensity was evident by the thick layer of ash and to confirm the lack of plant re-emergence soil was excavated in one cage that previously contained multiple individuals. No tubers were detected. Fortunately, Leafy Greenhood seeds from this population are held in long term storage in the SASCC and were extracted for the in-vitro propagation and translocation of this threatened orchid species.

The historic seed collections from this region have proved to be very significant today, and highlight the value of the ex-situ conservation work undertaken by seed banks. This project has been kindly supported by the National Bushfire Recovery program through a partnership with the Hills and Fleurieu Landscape Board.

Glycine latrobeana **Mt Bold flower. Photo: Dan Duval**

Glycine latrobeana **seedlings. Photo: Dan Duval**



Leafy Greenhood population post-fire Lobethal Bushland Park. Photo: Jerry Smith

Leafy greenhood propagation. Photo: Dan Duval

Workshop report

A Shared Vision for the future of Native Seed Management in Australia

SAMANTHA CRAIGIE[1]* AND LUCY COMMANDER[2]

[1]Greening Australia, NSW
[2]Australian Network for Plant Conservation
*Corresponding author: scraigie@greeningaustralia.org.au

The ANPC Australian Native Seed Sector Survey Report (Hancock *et al.* 2020) provided us all with the opportunity to better understand current sector structures and practices, the sector's capacity to meet current and future demand for native seed and the broad range of issues we face as sector participants. The ANPC Report identified major constraints and challenges and tabled the 13 most pressing issues. Its insights into the experience of our community also created an opportunity to catalyse change and created a challenge, a call to action to the sector.

Our unique native plant ecosystems are critical habitat for native animals and are essential in mitigating the impacts of climate change and extreme weather events. The native seed sector is vital to restoring Australia's ecosystems. In response to the devastating 2019-2020 summer bushfires, as part of the Commonwealth's $50 million Wildlife and Habitat Bushfire Recovery package, Project Phoenix was initiated to build and secure native seed and plant supply for restoration.

Project Phoenix is a 16-month national program, designed to be sector-led, guided by an external steering committee and co-ordinated by Greening Australia (GA). One of the key project outcomes is the delivery of a ten-year Native Seed and Landscape Restoration Strategy for Australia. A National Strategy will be a first for the sector and will be designed as a case for change. It will be aligned with stakeholders' views and will be action-oriented, with priorities for action to achieve in the short-term and with options for development in the long-term.

To complement and inform the Strategy, the Project will deliver 29 additional projects, that investigate issues, barriers and opportunities identified in the ANPC Report. The projects range from understanding the impacts of the fires, to building capacity of the sector, understanding the economics of the native seed market, supporting Threatened Species management and reinvigorating Florabank. With the Federal Department of Agriculture, Water and Environment as the grant manager, GA has engaged an additional 25 organisations to deliver these projects including eight state and territory agencies, six not-for-profits, five consultancies, three small businesses and two research institutions.

Figure 1. Regrowth in the Blue Mountains World Heritage Area May 2020. Photo: Greening Australia

The goal of the Project is to enable the seed sector to come together to develop the Strategy. By providing evidence and filling critical data gaps, the Project will find solutions that enable native seed management in Australia to be more sustainable and successful.

A vibrant and sophisticated Native Seed Industry would provide economic opportunities to sustain and improve existing businesses that have struggled to manage fluctuating demand. It could also generate business opportunities for rural and remote regions and importantly, engage with Indigenous Australians for reciprocal knowledge sharing and the development of sustainable enterprises.

The work of developing the Strategy has already begun, with 11 public workshops recently held online to inform the design. I invite everyone with an interest in the future of native seed management in Australia to join in the journey and to make your voice heard. You can be kept up to date with project progress and opportunities for consultation by joining the network. Every voice matters.

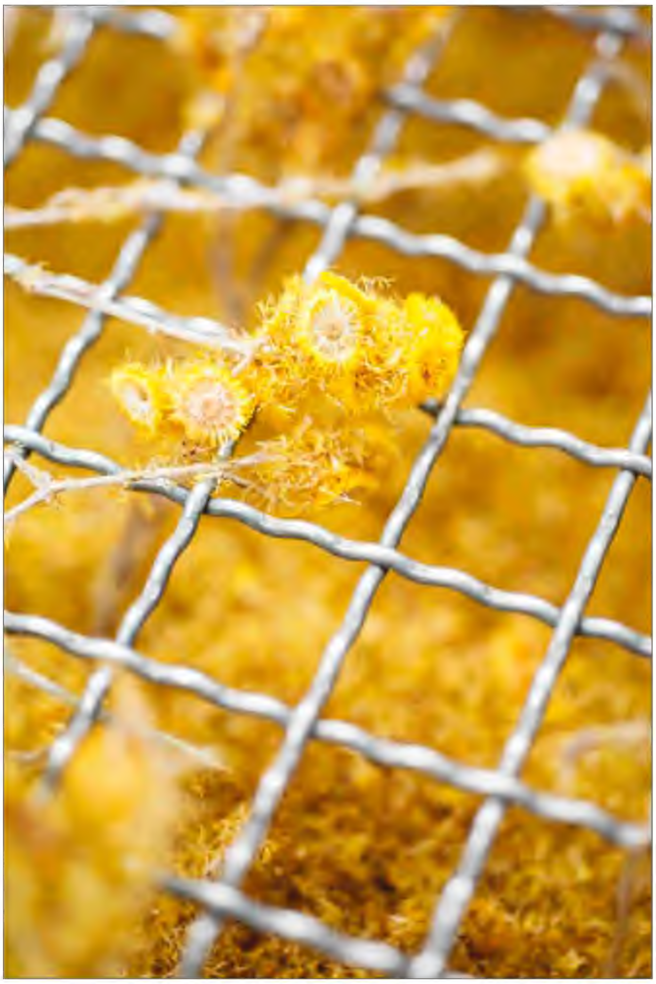


Figure 2. Chrysocephalum apiculatum being cleaned through a sieve. Photo: Greening Australia

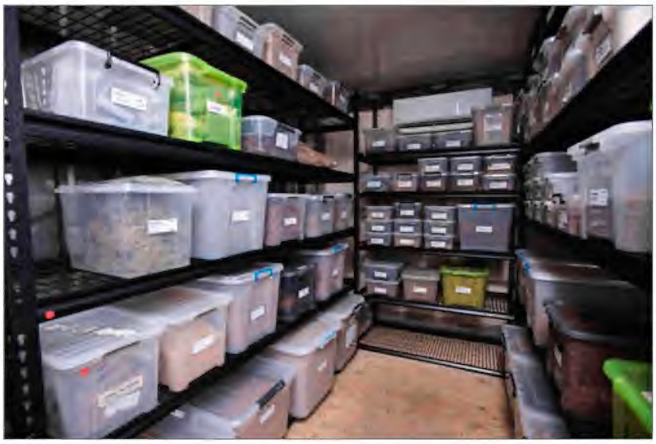


Figure 3. Restoration focused seedbank. Photo: Greening Australia

References

Hancock, N., Gibson-Roy, P., Driver, M., Broadhurst, L. (2020). *The Australian Native Seed Sector Survey Report*. Australian Network for Plant Conservation, Canberra.

Further information

https://www.greeningaustralia.org.au/projects/projectphoenix/

Project Phoenix External Steering Committee Membership

- Australian Association of Bush Regenerators
- Australian Network for Plant Conservation
- Australian Seedbank Partnership
- Australian Tree Seed Centre
- Council Heads Australian Botanic Gardens
- CSIRO
- Greening Australia
- Greenlife Industry Australia
- Indigenous Land and Sea Corporation
- Revegetation Industry Association of Western Australia
- Department of Agriculture, Water and the Environment (Grant Manager)

ANPC Member Profile

Andrew Randell Fairney

What is your current position?

I am the Chief Executive Officer at Seeding Natives Incorporated, an environmental charity that specialises in ecological restoration from the ground up, starting with the diverse ground layer.

What projects are you working on at the moment?

We are working on many projects that fall under our constitutional objective of restoring 150,000 hectares in the Adelaide Mount Lofty Ranges. The objective is to raise the percentage of high-quality native vegetation to 30% as research indicates that will stop the cascading loss of species we are experiencing here in one of Australia's biodiversity hotspots. If we are to have a chance at saving species and ecosystems from the uncertain future they currently face we need to engage the industries that occupy significant tracts of valuable land, so that is what we are doing.

One growing industry that in our region has been associated with properties becoming heat-sinks, barren wastelands or weed infested, is the renewable energy industry - and solar farms in particular. We are currently working on establishing low-growing biodiverse ecosystems, which are as complex as possible, underneath and around the panels to not only benefit the natural environment, but also for benefits for energy production and a reduction in ongoing site management inputs.

Another industry that has a significant footprint in our region, and often is a monoculture or close to it, is viticulture. We are working with a range of vineyards and the EcoVineyards project to establish diverse native grasslands within and around the vineyard. There are many benefits including, building soil quality, water retention, beneficial insects that help with pest management, reduced management inputs and creating valuable habitat.

How did you end up working in plant conservation?

For about 10 years I worked in the area of landscaping. I enjoyed the feeling of looking at the creation at the end of a project, the hard surfaces, paving and decking with the contrast of the native plant species strategically placed in the garden design that was envisaged from the blank slate at the project's inception.

Me in the process of mixing another diverse native grassland mix behind our innovative 'Blue Devil Mk2' multi mix seeder. Photo: Seeding Natives

As much as I enjoyed it, I thought there must be more to life. After a conversation with my wife, she filled out an online career survey and informed me that there was more to life, and that I would be good at working in the natural environment with a university degree. So that was it, I applied as a mature age student and 16 years later I find myself passionate about saving threatened flora, fauna and the ecosystems that they depend on.

What is your favourite plant and why?

I actually have two favourite plants that, to no surprise, are grassland species. The reason I cannot go past these two particular species is because of their amazing fragrance especially when you are harvesting and seed cleaning as well as the spectacular flower of one of them.

The first is *Bothriochloa macra* (Redleg grass) a C4 (summer active) native grass that is a beautiful green with red tinges on the edges of the leaf blades as well as the seed smelling incredible.

The second is *Eryngium ovinum* (Blue Devil), a threatened species which has a beautiful blue to purple flower that is mesmerising to look at, painful to touch (spikey) and intoxicating to smell, especially when cleaning.

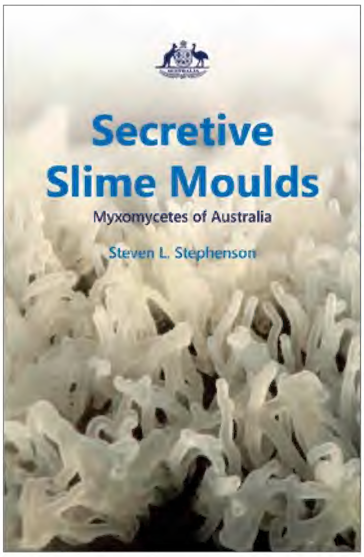
Why do you think the ANPC network is important and what do you see as our priorities?

The ANPC has a range of priorities and I feel the most important factors are education, research and pulling together the knowledge out there and making it accessible to the engaged public as well as people in the field of plant conservation.

Book review

Secretive Slime Mould

By Steven Stephenson
Hardback | March 2021 | $180.00 | ISBN: 9781486314133 | 382 pages | 245 x 170 mm | Publisher: CSIRO Publishing
Colour illustrations, Colour photographs



This book is principally a taxonomic work, a monograph, for all of the currently known Australian Myxomycete Slime Moulds. The ecologist in me is particularly delighted that there are seven pages about slime mould ecology, interactions and some general distribution information. Anyone interested in soils and nutrient cycles should learn about the importance of the 'microbial loop'. In living soils, the many slime moulds feed on the vast numbers of bacteria, moderating their populations and so influencing microbial communities. Not only are slime moulds important in soil, but also in the similar habitat of the 'canopy soil'. These epiphytic communities are held on branches and trunks of trees in wetter forests. Many slime moulds are found associated with other microhabitats like woody debris, bark, other plant litter, and even dung. And while less is known about these other microhabitat communities, the good number of slime moulds that can be cultured from moist chambers of such debris, suggests that they are common and are most likely eating the bacteria. Moreover, some even eat fungi that are involved in the active decomposition of wood and other debris!

The images and illustrations in this book are amazing and plentiful. These illustrations and images bring the name and other details together, resulting in a tangible understanding of these organisms living in our world. Small organisms are hard to imagine if we have not seen something of them with our own eyes. Seeing is believing and the wealth of pictures lets get deeply into the microcosms that these slime moulds inhabit. My only sadness is that none of the wonderful micrographs that I've seen over the last few years made it in. Hopefully a future edition will include these views of the finer slime mould details.

For those wanting to chase an identification through the groups down to genus and species of a slime mould they have found, there are a good number of short- to medium-length dichotomous keys. The pictures throughout the book help give confidence (or not) that we are on the right path. Descriptions are technical and taxonomic. So, for people just starting to discover slime moulds, they will need to consult the introductory figure outlining their fruiting structures to be able to understand the terms for the technical parts of these organisms. Learning any new group takes a bit of time to be able to interpret the descriptions that aid identification. Despite the technical language, descriptions and keys are clear and concise.

That there are species distribution data in this book is very useful. I would suggest anyone interested in distribution also look to the Atlas of Living Australia or other electronic distribution tools. And carefully consider records, particularly those supported by collections being the most verifiable. Already some of the species I looked up had new states and locations since this book has been finalised. Happily, this shows that slime moulds are being considered around Australia. This work is a great resource to get started in including slime moulds in our understanding of Australian biodiversity.

The author clearly has familiarity of, and also contributed significantly to, the published literature that supports the detailed work contained in this monograph. The hard cover, quality paper and printing complement the excellent scientific value contained within the 375 pages that make up this book. As well as being fully referenced, there is a scientific name index.

I fully recommend this great monograph as the new Australian primary reference for myxomycete slime moulds. I am hoping we get something similarly wonderful for the dictyostelid slime moulds!

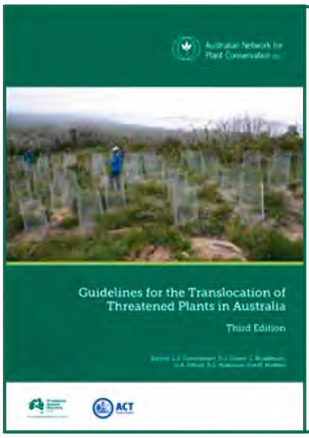
Sapphire McMullan-Fisher

Plantastic – A to Z of Australian Plants

Written by Catherine Clowes | Illustrated by Rachel Gyan
Hardback | February 2021 | $ 29.99 | ISBN: 9781486313211 | 64 pages | 280 x 215 mm | Publisher: CSIRO Publishing
Colour illustrations

One could always be dismayed that their favourite plant was not considered in this book, *Astelia australiana* in my case; however, with a large diversity of species to choose from, selecting a group of species that captures the essence of native plants in Australia was always going to be a tough task. The author has achieved this. This is a wonderfully illustrated book that is eloquently written. The book is highly educational and communicates the complexities of plant biology and ecology in a simple manner that is appropriate for children and adults alike. The choice of plants is excellent, highlighting the role of biogeography on plant distributions and the diversity of different traits that plants have evolved to be adapted to the Australian environment. The cultural importance of the plants is wonderfully included highlighting the importance of plants to aboriginal heritage and culture. This book is an excellent resource for teachers and students alike interested in plant biology and ecology. I figure if a trained plant ecologist can learn something new by reading this book then it should be highly recommended. I highly recommend it!

Craig Nitschke
Associate Professor – Forest and Landscape Dynamics
School of Ecosystem and Forest Sciences
Faculty of Science, University of Melbourne


Australian Network for Plant Conservation inc
Guidelines for the Translocation of Threatened Plants in Australia
Third Edition
ACT

Guidelines for the Translocation of Threatened Plants in Australia

The ANPC's brand new third edition is on sale now! Step-by-step information on how to do best-practice translocations, improve translocation success and contribute to preventing plant extinctions.

Third Edition 2018 | Eds L.E. Commander, D.J. Coates, L. Broadhurst, C.A. Offord, R.O. Makinson and M. Matthes. Australian Network for Plant Conservation, Canberra.

For more information and to order, go to http://www.anpc.asn.au/translocation

News and conferences

Revision and launch of the ANPC's Germplasm Guidelines 3rd edition

AMELIA MARTYN YENSON

Updates to the ANPC's best practice handbook for *ex situ* conservation are rapidly progressing, to produce the third edition of the publication '*Plant Germplasm Conservation in Australia – strategies and guidelines for developing, managing and utilising* ex situ *collections*'. Chapter drafts and case studies have been reviewed, with thanks to all those who have been involved in the writing and revision process.

Critically endangered *Rhodomyrtus psidioides* (Native Guava) faces extinction in the wild largely due to the impact of *Austropuccinia psidii* or Myrtle Rust. *Ex situ* collections form the centrepiece of long-term conservation strategies for the species by ensuring genetically representative, disease free material for ongoing research and possible translocation in the future.
The updated Germplasm Guidelines will include a revised chapter on living collections, and a new chapter on the role of the nursery in managing *ex situ* collections. *Ex situ* collections provide a source of material for translocation and can be managed as meta-collections with plant material shared between different organisations. Photo: Nathan Emery, Australian Institute of Botanical Science.

Planning and filming are underway for a series of videos associated with the Germplasm Guidelines revision, with the series name 'Plant Treasures', so that we can share the Guidelines' key messages with the plant conservation community. The series is funded by The Ian Potter Foundation and other benefactors.

The Germplasm Guidelines 3rd edition will be launched at the upcoming virtual Australasian Seed Science Conference (https://seedscience2021.com.au/). Be sure to register to hear more about the new content and why the Guidelines are so important in responding to threats to plant diversity.

Plant identity needs to maintained and tracked using tags over long periods of time as part of meticulous record keeping.
The Germplasm Guidelines are a science-based best practice handbook for managing *ex situ* plant collections. It includes many tips for curating *ex situ* collections including record keeping for collections and associated images and data. Photo: Nathan Emery, Australian Institute of Botanical Science.

ASSC 2021 – 6 to 10 September 2021

The Australasian Seed Science Conference will be held as a virtual event from the 6– 10 September 2021 as a result of the ongoing impact of the COVID-19 virus. Registrations have opened at https://seedscience2021.com.au/

Australian Academy of Science Fenner Conference on the Environment: 'Exceptional Times, Exceptional Plants'

The Australasian Seed Science Conference will also host the FREE Australian Academy of Science Fenner Conference on the Environment: Exceptional Times, Exceptional Plants. This event will focus on *ex situ* conservation strategies for Australian plants that cannot be conserved by conventional seed banking methods. It will be essential viewing for those who work in, or wish to better understand, alternative *ex situ* conservation methods such as cryopreservation, tissue culture and living collections.

Hear from key experts about why alternative *ex situ* methods are important, how to identify species that may require alternative methods, and attend a panel discussion on utilising all the tools of *ex situ* conservation to protect our national plant treasures.

This workshop is funded by a grant from the Australian Academy of Science. Funding for Fenner Conferences on the Environment (https://www.science.org.au/fenner-conferences-environment) is offered for conferences that bring together those with relevant scientific, administrative and policy expertise to consider current environmental and conservation problems in Australia, with the aim of contributing to the formation of policies that can alleviate some of these problems.

https://seedscience2021.com.au/fenner-conference/

REVIEW OF
Germplasm Guidelines
The Ian Potter Foundation
Australian Network for Plant Conservation Inc
CSIRO
Australian Seedbank Partnership
Australian Grains Genebank
Australian National Botanic Gardens
bganz
The Royal Botanic Gardens & Domain Trust
Auckland Botanic Gardens Where ideas grow
Royal Botanic Gardens Victoria
NSW Government

ANPC News

Australian Plant Translocation Database

The Australian Plant Translocation Database is now live and available to download for free from the ANPC's website. The database was assembled between 2016-2018 by researchers from the National Environmental Science Program's Threatened Species Recovery Hub. This incredible resource contains data on translocations for 379 species from around Australia. **https://www.anpc.asn.au/australian-plant-translocation-database/**

Myrtle Rust National Symposium

The Australian Plant Biosecurity Science Foundation, and partners including the ANPC, held a National Myrtle Rust Symposium from the 23rd to the 25th of March – a hybrid conference where key stakeholders came together in Ballina (NSW) to work through ways of implementing the *National Action Plan for Myrtle Rust in Australia,* combined with an online event to share the latest research, activities and thinking to a broader audience. Head to the website to find out more and watch the recorded presentations (this link is no longer working) **http://www.apbsf.org.au/myrtle-rust/**

Photo: Geoff Pegg

Myrtle Rust – national Statement of Concern now open for signatures

Australia needs a national response to the threat of extinctions caused by Myrtle Rust. A Statement of Concern was launched just before the Myrtle Rust Symposium held in March. The organisers, including ANPC Committee member Bob Makinson, are calling upon all Australian governments to respond to the threat of Myrtle Rust through co-ordinated and collaborative action to implement the National Action Plan for Myrtle Rust in Australia. First detected near Sydney in 2010, Myrtle Rust has naturalised along the entire east coast and has proven capable of infecting over 380 native plant species. Twenty to fifty of the currently-impacted species are threatened with severe decline. Some face near-term extinction. Read the Statement of Concern and sign it here: **https://www.apbsf.org.au/statement-of-concern/**

4 Seasons of Seed

On Friday 19 February ANPC Healthy Seeds Project Manager, Dr Martin Driver ran a seed collection workshop in Hay, NSW. The event was free to attend and was the first in a four-part series of workshops titled '4 Seasons of Seed'. For details on upcoming workshops visit **https://www.reboothay.com.au/womens-firearms-training**

Needwood seed (top). Photo: Sally Ware
Workshop (bottom). Photo: Jade Auldist

Hands Healing the Land

ANPC Florabank Project Manager, Dr Lucy Commander was involved in a 1-day restoration conference in Perth on Friday 19 March 2021. Hands Healing the Land – Community Science Conference provided an opportunity for land care practitioners, scientists and volunteers to share how they make a difference in caring for flora and fauna, learn from traditional owners and build community.

On Country at Gayini

On 9-11 March 2021, the ANPC's Healthy Seeds Project Manager, Martin Driver, was at Gayini in southwest NSW with members of the Nari Nari Tribal Council, Ian Woods, Irene Brettschneider, Jamie Woods, Mark Brettschneider, Allan Doidge, Sam Woods, Tara Dixon and Krista Schade. They were joined by veg expert Sally Mann and members of the Board of Murray Darling Wetlands Working Group, Ian Davidson and Kathy Ridge. The group was On Country to check in on progress over two seasons of property management, and refine the earlier revegetation strategy which was outlined during drier conditions, to prepare a Seed collection and regeneration strategy. NNTC conducted trials of different strategies to implement to create seed collection areas and enhance natural regeneration. A highlight was finding a Sugarwood tree setting seed. To see more photos from the day head to the Nari Nari Tribal Council Facebook page. **https://www.facebook.com/Nari-Nari-Tribal-Council-870708346335549/**

Report released: Action Plan for Australia's Imperiled Plans 2020

Released in March, this Action Plan aims to help prevent extinctions of Australia's imperilled flora through collation of existing knowledge and clear statement of required recovery actions. The Action Plan also provides a clear baseline for charting the trajectory of our imperilled flora. **https://www.nespthreatenedspecies.edu.au/media/sfbj01nh/2-4-plant-profiles-2020_whole-report_final.pdf**

Orchid Conservation Symposium

On 22 and 23 June 2021 the ANPC hosted an online symposium on Orchid Conservation, which was attended by 575 registrants from across 37 countries. Eighteen speakers from Australia, the UK, South Africa, Germany and Hong Kong shared their research and experiences. Topics included orchid pollination, germination and translocation. We learned about new techniques and technologies including camera traps, as well as illegal orchid harvesting. Over one year since the 2019-2020 fires, we heard about the effects of fire on orchid populations. We were treated to stunning photos of orchids across the globe including the Kimberley, where new species are still being discovered. A volunteer's eye view was presented and encouraged people to get involved in orchid conservation in their region. The ANPC would like to say thanks to all the speakers for preparing such interesting talks, to the Australian Government's Wildlife and Habitat Bushfire Recovery Program for funding both this Symposium and the larger project it is part of and the project leads, Ryan Philips, Noushka Reiter and Dan Duval. Also, a huge thankyou to the ANPC's Project Manager Lucy Commander, for seamlessly running both days, a tremendous effort!

Photo: Noushka Reiter and Ryan Phillips

Project Update – Healthy Seeds

The Florabank Guidelines, Model Code and Training package are well advanced in draft form for launching on the new Florabank website in the next few months. The Draft Healthy Seeds Roadmap will be amended to capture suggested inclusions for release in June. There has been extensive engagement in Project Phoenix consultation workshops that supports the directions of Healthy Seeds and the products of the Guidelines, the Model Code and the intent and proposed interventions of the Roadmap in NSW and beyond. Stakeholder extension and promotion of both the Guidelines and the Roadmap are also being developed in conjunction with Project Phoenix release in NSW. Contact Martin Driver, Healthy Seeds Project Manager for more information at projects@anpc.asn.au

Project Update – Germplasm Guidelines

Updates for the third edition of the Germplasm Guidelines are going well, with reviewer comments recently addressed by chapter working groups. Thanks to all those involved in the review and writing process! External reviews will begin shortly. Production of the 'Plant Treasures' video series funded by The Ian Potter Foundation is underway, with producer Chantelle Doyle and videographer Michael Lawrence-Taylor engaged to help spread the key messages of the Germplasm Guidelines. The video series will include interviews with chapter authors and footage of ex situ conservation processes in action. Planning is also underway for the launch of the Guidelines at the virtual Australasian Seed Science Conference on 6-10 September 2021.
https://seedscience2021.com.au/

Project Update – FloraBank Update

The update of the FloraBank Guidelines, as part of the Healthy Seeds Project, is reaching completion. The 15 modules are currently at the proof reading stage and will go to the graphic designer for layout very soon. We're all looking forward to the new edition of the Guidelines, which will have lots of photos to illustrate various aspects of native seed collection and use.
https://www.anpc.asn.au/florabank/

Australian Network for Plant Conservation Inc

13th Australasian Plant Conservation Conference

'Seeds to recovery'

Save the Date

Sun 3 - Thurs 7

APRIL 2022

Albury, NSW

More information at:
www.anpc.asn.au/conferences/apcc13/

Thank you to our generous conference partners:

AlburyCity
AUSTRALIAN NATIONAL BOTANIC GARDENS
NORTH EAST CATCHMENT MANAGEMENT AUTHORITY
AUSTRALIAN SEEDBANK PARTNERSHIP
Charles Sturt University
Federation University
COROWA DISTRICT LANDCARE
WOORAGEE LANDCARE
GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY
NSW GOVERNMENT
Local Land Services

Plant Cuttings

Editors' note: News excerpts are clipped from a diversity of sources. To read the articles in full follow the links attached to each clipping. The views expressed in these articles are those of their authors and do not necessarily represent the opinion of the ANPC.

Rodent eradication gives Lord Howe biodiversity boom

Lord Howe Island's natural environment is booming following the successful completion of one of the world's largest rodent eradication programs. In just over eighteen months the $15.5 million program has all but wiped out an estimated 300,000 plus rodents and other feral pests giving the island's native plants and animals a fighting chance at revival. **https://www.environment.nsw.gov.au/news/rodent-eradication-gives-lord-howe-biodiversity-boom?utm_source=miragenewsandutm_medium=miragenewsandutm_campaign=news**

Threatened plant survives Kangaroo Island fire

Scientists and volunteers have discovered three new patches of an extremely rare plant on Kangaroo Island, doubling the number of known populations. Botanist Dr Rick Davies said the plant, broad-leaved woodruff (*Asperula tetraphylla*), only occurs in south western Kangaroo Island, in areas severely burnt out by the summer 2019-20 bushfires.
https://www.theislanderonline.com.au/story/7109156/threatened-plant-survives-kangaroo-island-fire/

Kangaroo overgrazing could be jeopardising land conservation, study finds

The native species has reached numbers that are contributing to drier soil and less vegetation – and may be more damaging to conservation areas than rabbits. But a collaborative study led by UNSW Sydney found that conservation reserves are showing signs of kangaroo overgrazing – that is, intensive grazing that negatively impacts the health and biodiversity of the land.
https://newsroom.unsw.edu.au/news/science-tech/kangaroo-overgrazing-could-be-jeopardising-land-conservation-study-finds

Could native crop, kangaroo grass, become a regular ingredient in bread and help farmers regenerate land?

A native grass once harvested by Indigenous people, but these days more often overlooked as a roadside weed, could form the solution to restoring land exhausted by farming, researchers say.
https://www.abc.net.au/news/2021-02-08/kangaroo-grass-quest-as-the-next-super-crop/13132462

One Tree Per Child needs more locations to plant trees

Greater Shepparton City Council was currently seeking interest from residents to participate in the One Tree Per Child Project, by identifying suitably available roadside reserve areas with the capacity for planting local native indigenous trees, shrubs and grasses. **https://greatershepparton.com.au/whats-happening/news/news-article/!/456/post/one-tree-per-child-needs-more-locations-to-plant-trees?utm_source=miragenewsandutm_medium=miragenewsandutm_campaign=news**

Canberra research giving flora and fauna a fighting chance

A Canberra biotechnology company that specialises in the genetic screening of plants and animals is behind a $3 million investment in technology that will turbocharge the understanding of events such as bushfires and climate change on flora and fauna by accessing data from around the world that would otherwise be lost.
https://the-riotact.com/canberra-research-giving-flora-and-fauna-a-fighting-chance/438259

Plants most at risk after black summer megafires

While the prospects of recovery for most appear to be good, some species remain vulnerable, according to research published by Australia's national science agency, CSIRO, and the Centre for Australian National Biodiversity Research. The researchers compared remotely sensed satellite fire hotspot data with records of plant occurrence from herbarium collections to discover the plant species and ecosystems impacted in the burnt areas. **https://www.csiro.au/en/News/News-releases/2021/Plants-most-at-risk-after-black-summer-megafires?utm_source=miragenewsandutm_medium=miragenewsandutm_campaign=news**

Volunteers and experts work to remove invasive threat

Teams of volunteers have removed 80,000 seedlings along Kangaroo Island's West End Highway in an effort to help minimise the threat of the Tasmanian blue gum and are now looking to assist private land owners. **https://www.theislanderonline.com.au/story/7126963/volunteers-and-experts-work-to-remove-invasive-threat/?src=rss**

Brisbane beekeeper creates editable map to track African tulip trees killing native stingless bees

A Brisbane beekeeper has created a map for the public to locate African tulip trees in a bid to weed out the plant, which kills native bees. The tree is native to tropical Africa but was once planted as a street tree and garden tree, and while regarded for its red flowers, it is a serious weed which is toxic to native stingless bees and crowds out native vegetation. **https://www.abc.net.au/news/2021-02-17/beekeper-creates-tree-map-to-save-native-bees/13156240**

Orchids and wallabies: Conservation program to protect ACT's threatened species

The Brindabella midge orchid, a rather dowdy plant, may not be as beautiful as the Japanese white egret or the Central American dove orchids, as unusual as the laughing bumblebee or as risqué as the naked man – but it is one of the rarest flowers in the world, found only in a single location in Namadgi National Park. **https://canberraweekly.com.au/orchids-and-wallabies-conservation-program-to-protect-acts-threatened-species/**

Deadly fungus, poison fire coral, sighted near Cairns, prompting warning for bushwalkers

The world's second-deadliest fungus has been spotted growing near a popular hiking trail near Cairns, prompting a warning to bushwalkers. Poison fire coral was first recorded in Cairns in October 2019, and if ingested, can cause the brain to shrink, skin delamination, and even death. **https://www.abc.net.au/news/2021-02-19/deadly-fungus-poison-fire-coral-warning-for-bushwalkers/13169022**

Country Breakfast Features

If you like the bush and you're not a big fan of office jobs, I think you're going to be a little envious of Shane Wishart. He spends about half the year wandering through forests in Western Australia's beautiful south west. What's this dream job you ask? Well Shane is a professional seed collector. **https://www.abc.net.au/radionational/programs/countrybreakfast/cb-features/13170964**

Bush food, native plant products to be developed by Indigenous community and University of Queensland

More native bush products could turn up on shelves as Indigenous groups develop new businesses that champion native plants and bush food, in conjunction with the University of Queensland. Dale Chapman, an Indigenous chef and adjunct professor at UQ, is spearheading the project. **https://www.abc.net.au/news/2021-02-20/bush-food-project-aims-to-get-more-native-plants-in-pantries/13164350**

Overlooking the grasslands

Natural temperate grasslands once spread from the Melbourne to the South Australian border, thriving on the fertile volcanic soils of Victoria's Western plains. But they've been in decline from the moment settlers landed and are now critically endangered. The impacts of livestock grazing, cropping and urban sprawl mean about 1% are left. **https://www.abc.net.au/radionational/programs/earshot/overlooking-the-grasslands/13164414**

WA Bush Burn: Finding a balance between prescribed burning and biodiversity

Scientists and community organisations are lobbying the Western Australian government to re-think its policy of planned burning in parts of the state. **https://www.abc.net.au/landline/wa-bush-burn:-finding-a-balance-between-prescribed/13176970**

The Rare Bloom Project™A partnership to conserve Australian wildflowers

ASBP are excited to embark on a new collaboration with WWF-Australia and Botanica by Air Wick to deliver The Rare Bloom Project™. This project aims to improve conservation outcomes for 120 Australia's native wildflowers from fire affected and high-conservation-value areas over the next three years through seed banking, germination research and restoration. **https://www.seedpartnership.org.au/the-rare-bloom-project/**

Drying without dying

Urban greening takes a tiny turn with moss that just keeps on keeping-on (and cleaning our air). Guests: Alison Haynes, Associate Lecturer and PhD Candidate, University of Wollongong. **https://www.abc.net.au/radionational/programs/offtrack/drying-without-dying-moss/13187222**

Removing deer from Victorian national parks critical to bushfire recovery

Parks Victoria's removal of deer and other feral animals from some of the state's most popular national parks restarted on Monday 1 March in the Alpine National Park and is a critical step in helping nature recover from the 2019-20 bushfires. **https://invasives.org.au/blog/removing-deer-from-victorian-national-parks-critical-to-bushfire-recovery/**

Great Barrier Reef home to giant doughnut-shaped structures with unique animal and plant communities

Giant doughnut-shaped limestone mounds sitting in the Great Barrier Reef Marine Park, called Halimeda bioherms, have been building up on the seafloor off the Australian coast since the last ice age. It turns out the 10,000-year-old domes with sunken centres, which measure up to 300 metres across and 20m tall, host plant and animal communities unique to their surrounding environment. **https://www.abc.net.au/news/science/2021-03-02/great-barrier-reef-halimeda-bioherms-biodiversity-donut/13196754**

Leafing through the Botanic Garden's History

The Friends of the Wollongong Botanic Garden launched a coffee table-style book that celebrates the 50-year history of the Garden at an exhibition at Old Wollongong Court House from Saturday 6 March. **https://www.wollongong.nsw.gov.au/my-community/news-and-alerts/news/news/march-2021/leafing-through-the-botanic-gardens-history?utm_source=miragenewsandutm_medium=miragenewsandutm_campaign=news**

Farmers to get paid for planting trees in new biodiversity pilot

Farmers in six regions across the nation will have the opportunity to get paid to plant mixed-species trees on their property, under a new government trial program. **https://www.queenslandcountrylife.com.au/story/7154195/farmers-to-get-paid-for-planting-trees-in-new-biodiversity-pilot/?cs=4698**

Dinosaur-era plants flourish in Tasmania's internationally recognised Jurassic garden

You can't hang out with dinosaurs, but at a unique garden in Tasmania you can wander among the plant species they ate, flew over and trampled underfoot during the Jurassic era. **https://www.abc.net.au/news/2021-03-06/tasmanian-jurassic-garden-wins-global-genome-grant/13203436**

Heritage grants assist SA property owners with conservation projects

Conservation on private land within SA is set to be bolstered by $3 million with the delivery of a Heritage Grants agreement announced in April. The Revitalising Private Conservation in South Australia program initially seeks to offer property owners up to $10,000 for conservation projects to help better manage their Heritage Agreement areas. . **https://www.transcontinental.com.au/story/7164422/private-property-native-vegetation-boost/?cs=1538**

5 remarkable stories of flora and fauna in the aftermath of Australia's horror bushfire season

Around one year ago, Australia's Black Summer bushfire season ended, leaving more than 8 million hectares across south-east Australia a mix of charcoal, ash and smoke. An estimated three billion animals were killed or displaced, not including invertebrates. **https://theconversation.com/5-remarkable-stories-of-flora-and-fauna-in-the-aftermath-of-australias-horror-bushfire-season-155749**

Post-bushfire environmental recovery: citizen scientists capture thousands of observations

UNSW Sydney researchers have shown how a rapid-response citizen science project can provide data on plant, animal and fungus recovery following the 2019/20 mega-fires. **https://newsroom.unsw.edu.au/news/science-tech/post-bushfire-environmental-recovery-citizen-scientists-capture-thousands**

Tamar Valley Steiner School secures Landcare grant for native vegetation

Nature will reclaim a paddock used for traditional farming practices, all for education. The Tamar Valley Steiner School successfully secured an $11,000 Landcare Grant that will allow them to rehabilitate a paddock adjoining the school to a native food and plant area. **https://www.examiner.com.au/story/7167887/how-a-former-farm-paddock-will-teach-children-about-natives/?cs=95**

How we discovered a hidden world of fungi inside the world's biggest seed bank

This was the moment of truth. We'd spent countless hours meticulously sterilising seeds (1,710, to be specific), filling the lab with a cacophony of rattling as we shook them in bleach. We'd built a fungus city: great tower-blocks of petri dishes stacked on the lab workbenches, with different colours, textures and shapes of fungi all emerging inside. We'd extracted enough DNA that the freezer, stuffed full of tubes, threatened to revolt. **https://theconversation.com/how-we-discovered-a-hidden-world-of-fungi-inside-the-worlds-biggest-seed-bank-156051**

Perth's verge gardens grow friendships as well as plants, research finds

Verge gardens are springing up on public land outside homes, with surprising benefits, including forming friendships between neighbours. Natasha Pauli, a senior lecturer at the University of Western Australia's school of agriculture and environment, has been researching verge gardens and found the benefits extended well beyond urban greening. **https://www.abc.net.au/news/2021-03-27/perth-verge-gardens-grow-community-as-well-as-plants/100026918**

How to tell the new season is starting, according to the Noongar people of WA

After the blistering heat of summer, many welcomed March 1 as the start of autumn's cooler nights and mild days. In WA's South-West, the local Indigenous people also say a new season is beginning — but not because the calendar has ticked over into March. **https://www.abc.net.au/news/2021-03-27/indigenous-season-indicators-wa/100029476**

Kings Park Conservation

Western Australia is home to more than 8,000 known plants and the south-west of the state is recognized as a biodiversity hotspot. More than half of WA's plants grow nowhere else on earth, and Kings Park, Perth, has a number of display beds to showcase them, especially the many that are becoming rare or threatened in the wild. **https://www.abc.net.au/gardening/factsheets/kings-park-conservation/13290882**

The wonderful world of seed banks

Seeds – and the plants they grow – are a vital part of WA's ecosystem. And to protect our vast biodiversity, teams of seed collectors and scientists keep native WA seeds safe in specialised banks around the world. **https://particle.scitech.org.au/earth/the-wonderful-world-of-seed-banks/**

Albany Royal Botanical Gardens will be 'better than Kings Park' says leading botanist

Albany is set to become home to world-class royal botanical gardens that will be the envy of Perth, according to an internationally renowned botanist. The development located in the heart of the south coast city will be the first royal botanical gardens outside of WA's capital. **https://www.abc.net.au/news/2021-04-14/albany-botanic-gardens-better-than-perth/100066490**

Plants thrive in a complex world by communicating, sharing resources and transforming their environments

For other living organisms, social distancing comes more naturally. I am a plant scientist and have spent years studying how light cues affect plants, from the very beginning of a plant's life cycle – the germination of seeds – all the way through to leaf drop or death. In my new book, "Lessons from Plants," I explore what we can learn from the environmental tuning of plant behaviors. **https://theconversation.com/plants-thrive-in-a-complex-world-by-communicating-sharing-resources-and-transforming-their-environments-156932**

New initiatives to help nature in your own backyard

Residents across the South West Capes region are mobilising as part of a new environmental initiative to help nature in their suburban backyards, bush blocks and rural properties. Nature Conservation Margaret River Region (NCMRR) this week launched its 'For Nature' Landowner Stewardship Program. **https://www.margaretrivermail.com.au/story/7212186/new-initiatives-to-help-nature-in-your-own-backyard/?cs=12**

One of Australia's oldest native gardens can be found in suburbia

In 1901 a mercantile broker named John Watson bought 1.4 hectares of land in Balwyn and set about making a garden. Not so unusual, you might think. But Watson approached his horticultural endeavour with unusual zeal. Over two decades, he filled his plot with an ever-expanding array of Australian trees, shrubs and ground covers and then named it Maranoa, after the Maranoa River in Queensland. **https://www.brisbanetimes.com.au/lifestyle/health-and-wellness/one-of-australia-s-oldest-native-gardens-can-be-found-in-suburbia-20210409-p57hrc.html**

Local action inspires Nature Conservation Society recovery workshop opportunity on Kangaroo Island

As threatened plants have emerged and grown from the ashes across Kangaroo Island's burnt landscape so too have members of the community interested in the care and conservation of their local environment. This interest has been so high, that the Nature Conservation Society of South Australia (NCSSA) has decided to offer free workshops to the community to build people's capacity to tackle nasty weeds and monitor the post-fire recovery of bushland. **https://www.theislanderonline.com.au/story/7212104/local-action-inspires-bushland-recovery-workshop-opportunity/?cs=1021**

Saving the threatened plants and animals of Norfolk Island

Rats ran riot on Norfolk Island. Now some plants and animals have been saved, having faced the brink of extinction. Mel Wilson and Flossy Sperring tell Pauline Newman about the conservation management strategies in place with some success stories of plants and animals saved from the brink of extinction. **https://www.abc.net.au/radionational/programs/scienceshow/saving-the-threatened-plants-and-animals-of-norfolk-island/13305514**

Attack of the alien invaders: pest plants and animals leave a frightening $1.7 trillion bill

They're one of the most damaging environmental forces on Earth. They've colonised pretty much every place humans have set foot on the planet. Yet you might not even know they exist. We're talking about alien species. Not little green extra-terrestrials, but invasive plants and animals not native to an ecosystem and which become pests. They might be plants from South America, starfish from Africa, insects from Europe or birds from Asia. **https://theconversation.com/attack-of-the-alien-invaders-pest-plants-and-animals-leave-a-frightening-1-7-trillion-bill-158628**

Around the world in 80 plants

In a follow up to the highly successful *Around the world in 80 Trees* Jonathan Drori is back with another epic journey - This time his focus is on plants where he tells the stories and history of 80 carefully selected plants in a beautifully illustrated botanical travelogue. **https://www.abc.net.au/radionational/programs/latenightlive/80-plants_-jon-drori/13308532**

'Extremely rare' West Australian wildflower appears for the first time in 30 years

This is the first known photo of a critically endangered wildflower not seen in the wild for more than three decades. The remarkable discovery of the scaevola macrophylla flower, on Western Australia's south coast, is just the fourth recorded sighting of the species in 180 years. **https://www.abc.net.au/news/2021-04-24/scaevola-macrophylla-wa-wildflower-near-albany/100091714**

Events and Opportunities

APCC13

Save the date for the 13th Australasian Plant Conservation Conference (APCC13) to be held in Albury, NSW, 3-7 April 2022. With the overall theme '*Seeds to Recovery*' presentations will cover topics including recovery of native plants and vegetation after fire, and native seed supply. More details to come at **https://www.anpc.asn.au/conferences/apcc13/**

What the Flora?! – New science video series

The Royal Botanic Garden Sydney are releasing a science video series on plants and flora conservation research. You can watch episodes on their Youtube channel: **https://www.youtube.com/watch?v=XhhYNOTDS78andlist=PLxebOIqQs3h3xD64g7l_F7gChyYj4OQca**

Stewardship of Country – webinar series recordings

The Royal Societies of Australia and Inspiring Victoria produced a series of three webinars to generate discussion about landscape and environmental stewardship—bridging Indigenous, scientific, economic and social perspectives with ideas that support practical action and public good. Recordings of the webinars can be found here: **https://www.scienceaustralia.org.au/register/**

Combined NSW and VIC Weeds Conference – 23-26 August 2021, Albury NSW

Jointly supported by the weeds societies of New South Wales and Victoria – weeds without borders, the Conference will be held in the Albury Entertainment Centre from 23-26 August, 2021. The conference will focus on skills development, recognition and has planned four field trips. Early bird registrations open on 22 March 2021. For more information see **https://www.nswweedsconf.org.au/**

Research round up

TOM LE BRETON
University of New South Wales

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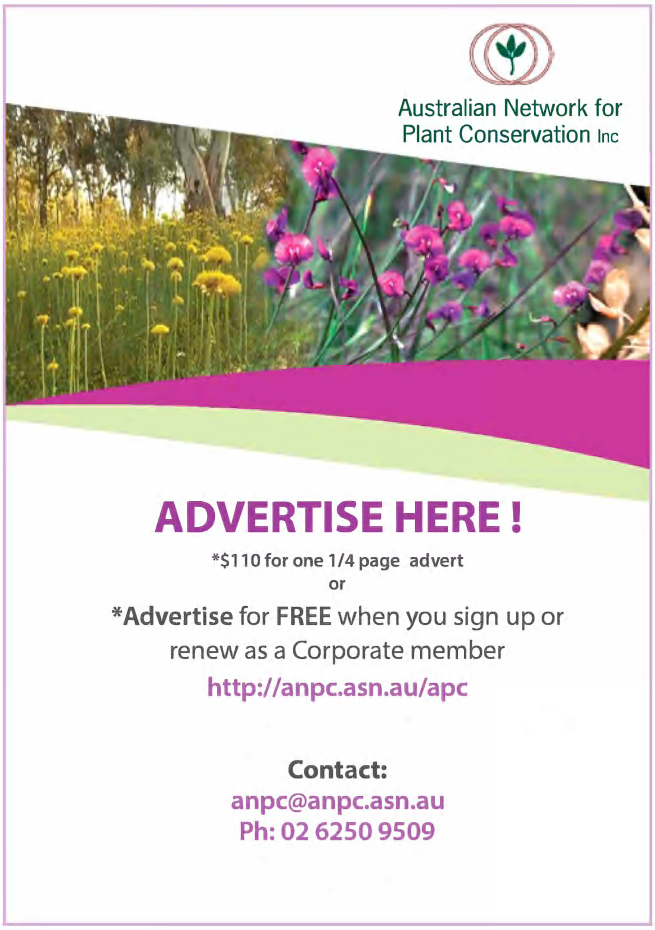

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